"Journal of Gas Lighting, Water Supply, and Sanitary Improvement."—June 6, 1916.—Registered as a Newspaper.

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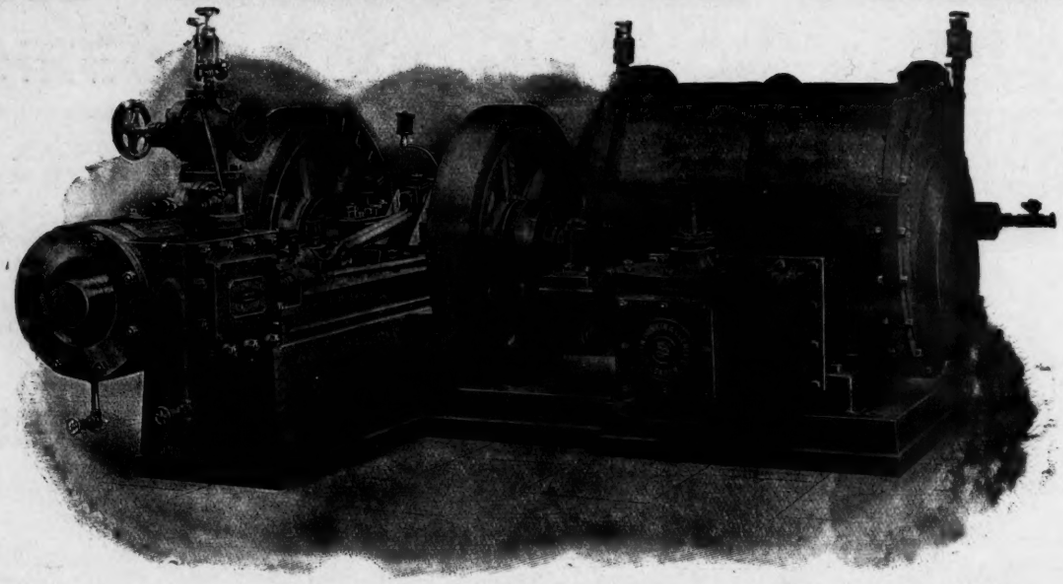

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JOURNAL OF GAS LIGHTING & WATER SUPPLY.

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VOL. CXXXIV., No. 2769.] TUESDAY, JUNE 6, 1916. [68TH YEAR.

EDITORIAL NOTES.

A Calorific Power Standard for All.

THE war is responsible for the Government initiating legislation whereby every gas undertaking (on the passing of the Bill, which will, we understand, be pushed forward at the end of the recess with all possible speed) may put itself in a position to obtain, expeditiously and practically without expense, relief from its illuminating power standard and penalties, and have substituted therefor a calorific value standard and forfeitures. Of course, the object of the introduction of the Bill at the present time is to promote the extraction of benzol and toluol from town gas; and there is no doubt—at any rate, it seems quite manifest—that in this matter the Board of Trade are acting in concert with the Ministry of Munitions. It may also be taken that the reason why a measure has not been introduced to bring automatically and at once, without further application, all gas undertakings under a calorific standard value in lieu of the illuminating power one is that an opportunity may be given to consider, if any are forthcoming, exceptional circumstances regarding the proposed change. But the facts that the Government have now taken the matter in hand, and are supplying facilities for effecting the substitution of the one standard for the other, afford proof that the departments concerned will brook no frivolous objections, but will without delay make the necessary order unless there is substantial reason for not doing so. On the Bill becoming law, in very little time all gas undertakings that are now washing their gas with oil should be found freed of the old fetters of the illuminating power standard, and under a calorific value prescription; and those undertakings that have not yet adopted the oil-washing process ought very shortly to be in the running. The change from the one standard to the other is a necessary prelude to the permanent development of the operations of gas undertakings in the matter of benzol recovery, and entering into—in part or whole, or co-operatively—tar distillation.

The Bill was introduced into the House of Commons last Thursday, by the Parliamentary Secretary of the Board of Trade (Mr. E. G. Pretyman); and its text is set out on p. 500 of this issue of the "JOURNAL." The whole Bill is comprised in two clauses; but the first and principal one is divided into four sub-sections. In the first place, there is seen the desire to facilitate applications. On application being made, "the appropriate Government Department"—that is to say, for companies, the Board of Trade, and for local authorities the Local Government Board, or the Secretary for Scotland, or the Local Government Board for Ireland—may, "if they think it expedient, and subject to such conditions, if any, as they consider proper," by order, substitute a calorific power standard and penalties for the illuminating power standard and penalties, and prescribe the provisions for testing. The wording indicates that merely formal application is necessary. There is no suggestion of "Gazette" notices, or the observance or application of all the routine required in the case of the promotion of a Bill or Provisional Order; so that it will not be requisite, if our reading of the Bill be correct, to apply to the "appropriate Department" through Parliamentary Agents. Thus the expense of the application will be very moderate. Then as to the power of the Department to apply such conditions (if any) as they may think proper, it may be taken as almost certain that the model clauses will be followed, with probably a preference for the modern level 500 B.Th.U.—total heat value—as the standard, instead of 540 B.Th.U., with 7½ per cent. margin before the penalty-line is reached. It will be particularly noted that "in considering the expediency of making such an order, "the Department shall have special regard to whether the "undertakings have erected and worked, *or are prepared to* "*erect and work*, suitable crude benzol recovery plant for the "production of benzol and toluol."

It has been mentioned that there is no suggestion as to "Gazette" or other expensive advertisement notices. All that the Bill provides for is that the "appropriate Government Department" shall require the applicants to give public notice "in such manner as the Department may consider best adapted for informing persons affected of the "application for an order." The whole idea is simplicity, so that the mode of giving notice, it may be taken for granted, will not be of a very imposing nature. If there are objections, it rests with the Department to say whether or not it is expedient to hold an inquiry. But if applicants keep to the terms of the model clause, and adopt a calorific standard of 500 B.Th.U. (total heat value), there will have to be a very strong case presented by opponents before, we should fancy, one of the Departments will think it "expedient" to go to the trouble of holding an inquiry. Moreover, there will be no disposition on the part of any one of the Departments to have on hand, especially at this time, a number of inquiries into a matter that has been adjudicated upon so often, and has had the result crystallized into a model clause that is so generally accepted alike by gas companies and gas supplying local authorities.

The measure is a belated one, in view of the circumstances of gas use and national needs; but we give it hearty welcome as another step in the economic progress of the gas industry, and in the ability of the industry to render greater service to the nation and to assist in making the country more independent, not only now but after the war, of external aid in the matter of certain essentials.

Men of Account in the Industry's Politics.

THE Institution of Gas Engineers are meeting to-day; and, apart from the subjects entered on the *agenda* for consideration, there will no doubt be a large amount of private conversation on such topics as coal, tar and oil washing, pitch accumulation and utilization, and 10 per cent. reduction circulars. Perhaps, too, there may be something said on the subject of central organization. If so, it is to be hoped that the disclosures of the recent Manchester Coal Conference will not be overlooked regarding some of the men who are badly wanted in the premier organization, but have no place in the Institution of Gas Engineers, which take headship for the time being simply because there is not in existence a central body representative of all interests, and having the power to act both authoritatively and promptly. The conference was reported in the "JOURNAL" for May 23; and the report has attracted considerable interest, not only owing to the importance of the question of coal supplies, but owing to the character of the proceedings and the statesmanlike speeches that were made by Chairmen of Gas Committees and of Gas Companies, and others concerned in the work of gas administration as distinct from gas engineering.

The speeches revealed how deeply the men in controlling power over gas undertakings are interested in the work of the industry, and have an intimate knowledge of its requirements. Even the veteran in gas engineering and administration, but youthful in temperament, Mr. H. E. Jones, was, at the conference, evidently struck by the amount of power which the industry possesses in its administrators who are not gas engineers. He remarked: "Listening to the extremely able, logical, and well-thought-out speech of "Alderman Phillips, one could not help being struck "by the important statistics he had collected, and which "proved that really there was no proper ground for this "[the coal] shortage, or for this exaggeration of price." Again, "Alderman Phillips's speech was the most statesmanlike *résumé* of the whole position to which he had

"ever listened." This was a well-deserved compliment; and the same could have been paid to the speeches of Alderman Kay, the Chairman of the Gas Committee of the Manchester Corporation, Bailie Irwin, the Chairman of the Glasgow Corporation Gas Committee, Mr. Hanbury Thomas, the Managing-Director of the Sheffield Gas Company, Mr. Robert M. Noble, Chairman of the Dundee Gas Commissioners, Mr. W. A. Nicholls, Chairman of the Stretford Gas Company, Mr. Alfred Tyrer, of the Liverpool Gas Company, and Alderman H. Wilde, of Oldham. Every one showed a sharp penetration, and strong grasp of the situation, and a keen desire to protect the gas industry by any means within the collective power. The fact is that in the chairmen, directors, committeemen, and others concerned in the gas industry who do not profess or call themselves gas engineers, we have men of affairs and men of influence, whose brains and personal power are largely lost to the general political work of the industry (save in connection with such a modest, though important, matter as advertising and other gas propaganda work) owing to their exclusion from participation by antiquated notions which sufficed for their day of birth, but have no place in, or application to, the larger requirements of these times. Such a position is an insult to men of such calibre and proved interest; and every day there is perpetuation of the present conditions, there is injury to the industry.

Now those who are concerned in the promotion of the highest interests of the industry should note that the important conference in Manchester was not convened by any one of the existing organizations of the industry, but by Aldermen Kay and Phillips. It is true that on the Committee appointed to prosecute the movement set on foot at the conference, there are the names of Mr. John Young, President of the Institution of Gas Engineers, Mr. Charles Carpenter, D.Sc., Mr. H. E. Jones, and Mr. John Bond—all members of the Institution. But, excepting Mr. Young, their appointment to the Committee was due not to their membership of the Institution, but to their identification with important and representative gas undertakings. Now had there been a central representative and fully alive organization in which the prominent administrators and all chief executive officers of gas undertakings had place, the conference would have been convened through its machinery. Readers may put their own interpretation upon the fact that it was not convened through any existing organization, and that the Committee are pursuing an independent course. The position wants to be made very clear (even at the risk of saying things which may cause us to incur the displeasure of a few, although writing in the interests of the entire industry), in order to drive it home, and secure for it adequate consideration and action. With this in view, the question may be asked, whether the present premier organization of the gas industry would have been able to constitute, from its own membership, a Committee of such influence to deal with the coal question as the one elected at the conference? To save reference back, the composition of the Committee may be re-stated (mentioning cities and towns in alphabetical order): Alderman James Craig, J.P., Chairman of the Belfast Gas Committee, Alderman J. H. M'Gaul, J.P., Chairman of the Birkenhead Gas Committee, Councillor J. H. Crook, Chairman of the Bolton Gas Committee, Alderman J. W. Newbold, J.P., Chairman of the Derby Gaslight and Coke Company, Bailie Irwin, Chairman of the Glasgow Corporation Gas Committee, Mr. John Young, President of the Institution of Gas Engineers, Alderman Penrose Green, J.P., Chairman of the Leeds Gas Committee, Councillor G. E. Hilton, Chairman of the Leicester Gas Committee, Mr. Henry Wade Deacon, J.P., Chairman of the Liverpool Gas Company, Mr. D. Milne Watson, Managing-Director of the Gas Light and Coke Company, Mr. Charles Carpenter, D.Sc., Chairman of the South Metropolitan Gas Company, Mr. H. E. Jones, Chairman of the Wandsworth Gas Company, Alderman W. Kay, J.P., Chairman of the Manchester Gas Committee, Mr. Thomas Waddom, Secretary of the Newcastle-on-Tyne Gas Company, Alderman A. Ball, J.P., Chairman of the Nottingham Gas Committee, Alderman H. Wilde, J.P., Chairman of the Oldham Gas Committee, Alderman Phillips, J.P., Chairman of the Salford Gas Committee, Mr. Hanbury Thomas, Managing-Director of the Sheffield Gas Company, and Mr. John Bond, Gas Engineer of Southport. If an equally influential Committee could not have been elected from the existing premier organization, then the further question may be put, Why not?

Costs of Retort-Settings, including Maintenance and Renewals.

Home makers of retorts and other refractory materials had, a few years ago, to bear a good many cuffs in relation to the quality of the goods they were turning out, and adverse criticism was loaded upon them for their backwardness in instituting scientific investigation and control at their works. They suffered it all with a good deal of *sang froid*, but with a very obvious desire to fall in with the wishes of their customers so far as their practical experience enabled them to endorse the wishes as being fair and valid. But the arch-critics now become the criticized, as seen by certain remarks in the discussion on the paper on "Silica and Fire-"Clay Materials" which Mr. John West read at the recent meeting of the Manchester Institution, and upon which comment was made in our last issue. One speaker did not think the work of the Refractory Materials Committee has yet given gas engineers much for which to be thankful, and that any indebtedness there may be rather applies to favours to come. There is one thing, however, for which we have to be thankful, and it is that what Mr. F. J. Bywater did, and what the Committee (whose Chairman is Dr. Harold G. Colman) have since done—and in the composition of the Committee are members of the Fireclay Section of the Society of British Gas Industries—have stirred up a considerable amount of interest and study of the refractory materials question by makers and buyers alike, and this will result to the common advantage.

The question, however, arises as to whether the full weight of the criticism levelled against the makers was wholly deserved. It is very doubtful when all the circumstances are taken into consideration; and, when this is done, it is found to be more than possible that a large share of the blame for a shorter life (as measured by time) should be apportioned to the new conditions of use of retorts and other refractory materials. It only needs mentioning to show the absurdity of speaking of the life of retorts by the number of days, compared with the life in days of twenty or twenty-five years ago, when working temperatures were lower, when the weight of coal passed through the retorts was less in given time, and when the volume of gas made per mouthpiece per day was also relatively low. There must be comparable conditions in every respect if the life of retorts is to be assessed in terms of days. A better plan is to take the tonnage of coal carbonized, and the costs per ton, so long as we understand definitely the items comprised in these costs. Mr. J. G. Newbigging called attention to this matter during the discussion on Mr. West's paper; and the retort makers will be very grateful to him for publishing in our columns a piece of practical testimony which, when consideration is given to conditions under which the costs were realized, shows that, after all, the retort makers—at any rate, those supplying Manchester—have done a good deal in keeping pace with requirement. At Mr. Newbigging's request, the Accountant of the Corporation Gas Department has tabulated the actual costs—year by year, and divisioned into quinquennial periods—of retort-settings within the arch above the stage-floor level, including maintenance and renewals, and the maintenance of the producers. In the five years ending 1900, the costs averaged 7·84d. per ton of coal carbonized; in 1901-5, 7·66d.; in 1906-10, 5·04d.; and in 1911-15, 3·81d. Just consider the higher heats of modern working, the heavier charges, and the increased make, and the difference between the 7·84d. of the five years ending 1900 with the 3·81d. of the five years ending 1915, is more extraordinary than if the working conditions had remained uniform. The total expenditure per year, it will also be noticed from the tabulated statement, has been reduced considerably, although the tonnage of coal dealt with was greater in the last decade than in the previous one. But the interesting and comparable figures, are, bearing in mind the harder working of modern times, those rendered on the per ton basis; and the 50 per cent. or so reduction, Mr. Newbigging attributes to careful experimenting with well-known makes of fire-clay materials, and good workmanship in re-setting.

It is very useful and instructive to have such figures as those presented in the table in question; and we invite other engineers to send for publication their costs also worked out on the same basis. Mr. West, in his paper, referred to the use of silica segmental retorts at Sheffield; and it would add to the value of these comparative costs now and a time ago, under the present and then current

conditions, if users of segmental retorts would supply their per ton costs. This would enable comparison to be made with the costs for moulded retorts—such as we have had supplied from Manchester, and give better ground than has hitherto been afforded upon which to base judgment.

Working Tar Dehydration Plants.

DIFFICULTIES have been experienced in the working of tar dehydration plants; but difficulties are made to be overcome. Not in all cases have the difficulties met with in connection with the plants in question been dealt with in the best possible manner. We like to see something to the credit of advantage when the surmounting of a difficulty cannot be achieved without the production of something in the nature of a disadvantage. But this has not been the universal case in respect of the methods adopted to overcome a deficiency in, at any rate, one type of dehydrating plant. In an article contributed to our columns this week, Mr. H. O. Carr and Mr. U. O. S. Nairne call attention to the defect, condemn a method that has been applied for counteracting it, and make a suggestion that is found to be the most effective for dealing with the trouble. The defect is the shortage of condensing power; and there are instances where this has been so inadequate that the benzol, toluol, and solvent naphtha could not be condensed at all. This is due to the amount of tar passing through the condenser being too small to condense the vapours distilled from the tar when heated to a sufficiently high temperature for the recovery of the carbolic oils. The "remedy" applied has been to substitute water, in place of tar, as the condensing medium. The authors describe this as "unfortunate," as it creates several sources of waste; and, as a matter of fact, it is opposed to the heat efficiency of the system. Using the entering cold tar as the cooling agent causes a transfer of heat from the high-temperature vapours to the tar; but this beneficial transfer of heat is lost if water is substituted. It is then found in cases that the furnace alone, through the absence of tar preheating, is not sufficient to raise the tar in the still to the temperature required to drive off the carbolic oils. Even if the furnace be large enough, through the loss of heat at the initial stage, more fuel would be required to raise the tar to the necessary temperature. Therefore, it comes about that the "remedy" means waste of heat, fuel, and water. So as not to lose the advantage of the use of the cold tar as the cooling agent in the primary condenser, Messrs. Carr and Nairne recommend that the method should be continued, and an efficient water-cooled condenser be incorporated in series to condense the lighter oil vapours uncondensed in the primary condenser. Besides the heat transfer to the incoming tar, another benefit would be the need for much less water for condensation. Separately stored, the oils recovered in the water-cooled condenser are worth double the market value of the oils from the tar-cooled condenser. This, briefly put, is the plan of Messrs. Carr and Nairne, which, even though there are little disadvantages attaching to it in the way of an extra piece of plant and the use of water, certainly has the effect of producing credits which entirely obliterate the debits. Those with guaranteed or unguaranteed plants should carefully consider the recommendations of the authors.

Manchester Coal Conference Committee.

The influential Committee of representatives of gas undertakings elected at the recent coal conference at Manchester [see *ante*, p. 403] have commenced operations, and are getting matters into proper swing with the intention of not leaving a stone unturned in the attempt to secure something effective regarding the objects for which they were appointed. They met last Friday at the Town Hall, Manchester, and decided to send the resolution passed at the conference to the Prime Minister, the President of the Board of Trade, and the Minister of Munitions, with an intimation that the Committee intend to co-operate with other bodies interested in the coal supplies to public utility undertakings in any representations which it may be desirable to make to the Government upon the question. Prior to the meeting, a circular was issued to gas undertakings, asking for information regarding coal requirements, supplies, and stocks now and in normal times, so as to obtain comparative figures. Three other questions included in the circular were extremely pertinent to the existing conditions created by the coalowners in connection with coal contracts in seeking either to evade the terms of the Price of Coal (Limitation) Act, or to secure the best possible prices under it, through waiting before making contracts for the period of the highest corresponding prices in the prescribed year ending June 30, 1914, or by declining to sell under contract, and realizing still higher prices by means of open sales. The three questions were: (4) "Quantity of coal and cannel already purchased for the ensuing twelve months." (5) "Quantity of coal and cannel you have been unable to purchase owing to collieries refusing to quote or enter into contracts." (6) "Have your collieries attempted to obtain higher prices than are permitted by the Price of Coal (Limitation) Act, 1915; if so, how much more per ton have they asked?" On inquiry of the Hon. Secretary to the Committee (Mr. Fredk. A. Price, Town Hall, Manchester), we learn that a statement is now being prepared, from the information obtained through the issue of the circular, showing the position of most of the large gas undertakings in relation to supplies and stocks and the other matters referred to, so that there will be some concrete information to be laid before the Prime Minister and his colleagues.

Grand Council for the Gas Industry.

In the course of the proceedings at the meeting of the Coal Conference Committee (referred to in the previous paragraph), the hope was expressed that the "Grand Council" which it is proposed to form to deal with matters affecting the gas industry generally would be a *fait accompli* before approaching the Government. We do not care what the central body is called, so long as it is representative of interests, can act authoritatively, and supplies the gas industry with something that can be operative promptly, influentially, and effectively. But it will be advisable to see something as to what is proposed and its powers before finally accepting any scheme. However, the idea of a central advisory body or grand council, was in mind when the matter of organization was being discussed at the time the late Mr. Edward Allen was President of the Institution of Gas Engineers; and it was his great regret that some such body was not brought into being during his presidency. But he told us that it was coming; and coming now it undoubtedly is. We are sorry Mr. Allen only lived to see the usual abortive result to the effort then put forward. Such results had attended all previous endeavours to put at the head of the industry a body to represent it in its entirety. Now, however, a different order of men are making claims; and they appreciate what some of those interested in organized chaos have not appreciated. Never has there been a time in history when a proper central organization, grand council, or whatever formation and name are chosen would have been more useful than now in the gas industry. The Coal Conference Committee recognize this; hence the hope as to the Grand Council being a *fait accompli* before approaching the Government.

Future of Sulphate of Ammonia and Benzol.

It is necessary in these times to look forward in connection with the secondary products of gas manufacture as in other matters. Some of those interested in the management of gas-works are so content with the comfortable position of having all residual products, excepting pitch, contributing a decent part to revenue, that they are not thinking much of the future of these commodities. This is not very prudent. Mr. D. Bagley has been making a study (as will be seen from an article elsewhere in this issue) of the prospective relative positions of sulphate of ammonia and benzol as revenue producers; and he arrives at the conclusion that the ratio of contribution of benzol to the total revenue from bye-products will equal, and then surpass, that of sulphate of ammonia. The future position of sulphate is very doubtful; the position of benzol in respect of both its utilization and value promises to be an expanding one. The synthetic manufacture of ammonia, and the increasing yield in normal times of fertilizers from all sources, is bound, when peace is restored, to have a price-depressing effect on sulphate of ammonia produced from the carbonization of coal. The competition will be the strongest in the foreign markets, where the greater proportion of our make is at present sold. This points to the need for every effort being made to increase home consumption. Upon this a good deal of attention has been bestowed, but not with the marked effect that one would have liked to see. However, what may be lost on

sulphate must be made up by developments in other directions. The distillation of tar at the place of production, or as near to it as possible, is an economy—providing conditions will allow. The markets for benzol look promising; and there is likely to be an ever-increasing demand. It will be wanted for motor purposes and for aniline dye making; and other pure products from it will also be in demand. The directing finger stands out clearly. It is likely that what is being done on gas-works now in benzol recovery will never be relinquished; and it is a development that in future will help to compensate any disadvantages in market value that sulphate of ammonia may suffer.

Practical Fuel Economy.

There will be a great deal of sympathy with the lines of the address that Mr. John W. Lee delivered on "Fuel Economy" before the Yorkshire Junior Gas Association. He would like to see the campaign for fuel saving started at the point of least resistance, rather than at some other points where objections, steep and stubborn, will oppose themselves to the early success of the valuable mission. He finds there has been a lot of talk on the subject, many schemes have been propounded whereby there could be coal-economy, and the advocates of their adoption have been speaking of savings in millions of tons and millions of pounds sterling. Great schemes cost much money; and existing methods are not going to be scrapped in bulk to allow of the adoption of magnificent schemes, and of the spending of fabulous sums in order to realize economy of fuel, though a wealth of reward be shown on paper. Revolutions result from gradual and patient work; not from sudden conversions in faith or practice. Mr. Lee regrets that, at the fuel economy meetings, more opportunity has not been given to audiences to speak of their own peculiar conditions and defects, and that suggestion has not been made as to how to deal with them. This is where the beginning ought to be made—at the stage of existing plant and practice. In existing plants in which fuel is used, there is a great deal of leakage and waste; and it is the suppression of leakage and waste that is going to have the quickest effect. Mr. Lee deals with boilers, furnaces, and so forth; and he is treating of something of which he knows. Start there, and good work will soon be accomplished. From there expansion and development will follow, until eventually perhaps even schemes that are to-day looked upon as visionary may be materialized, and take common part and place in the day's work and in the conveniences of the community.

Daylight Saving and Gas Consumption.

In our "Miscellaneous News" columns, there is a compilation of early experiences as to gas outputs under "daylight saving" conditions. The experiences vary. In some instances, there have been decreases in consumption; but in certain of these we see that comparison is made with the corresponding days of 1914, instead of the war-conditioned days of 1915, with the reduced street and shop lighting then obtaining as now, but generally in less degree. The reason for projecting comparison back to 1914 is due to the Whitsun holidays having interfered with the conditions of demand a year ago; but this can be avoided now by making comparison with a week later. In other cases, an actual increase is shown compared with a year ago; in others, again, it is found that any additional decrease in lighting consumption is about compensated for by the increased use for cooking, power, and other industrial purposes. Generally speaking, up North (there is little news from the Southern undertakings), it is considered that, with the diverse uses of gas, there will not, through daylight saving, be an appreciable difference in output as compared with last year. But what about electricity? Southport reports a decrease of 20 per cent. and Wallasey of 12 per cent. in the first week of the changed hours. We shall be pleased to receive comparative figures, from the engineers of any gas undertakings. The different experiences should be of considerable interest.

Gas-Works of Local Authorities.

The present issue of the "JOURNAL" will be found to contain, as did also the last one, interesting statistics with regard to the operations of municipal gas undertakings during the past financial year. In some matters experiences have differed; while in other respects the tale to be told is practically the same in all cases. Glancing first at Birmingham, it is seen that the increase in the quantity of gas sold during the twelve months to March last was over 900 million cubic feet. And this in spite of an appeal during the winter, which was met by a ready response, to consumers to exercise the strictest economy in the use of gas for all purposes. No wonder the Committee experienced some anxiety regarding the maintenance of the supply to munition factories. On the other hand, Brighouse reports a decrease of 6 per cent. in the output of gas, mainly owing to the reduction in street lighting. For the time being, public lighting has been abolished at Evesham; but in spite of this there was an increased sale of gas during the past year. A loss the previous year at Hebden Bridge, has been turned into a substantial profit on the present occasion; while the working figures are stated to constitute a series of records for the undertaking. Much satisfaction has been expressed by the members of the Hinckley Urban District Council with the results which have been achieved during the twelve months. The net profit is a little less; some decrease of the gas consumption in houses and shops being off-set by the supply of a larger quantity for power purposes, which, however, was sold at a lower price. A bigger profit than had been expected is reported at Lancaster; and the whole of it is being wisely transferred to the reserve fund. A large deficiency at Leeds is replaced by a very satisfactory net surplus, made up of an increased charge for gas and higher returns from residuals. Coming to Nottingham, a small decrease of about 1½ per cent. in the sales of gas is found; but, with the higher costs prevailing, there is little change in the gross profit realized, owing to an increase made in the price of gas. At Rotherham, the quantity of gas sold was 8½ per cent. less than in the preceding year—a result which was caused entirely by the restricted lighting. Both the gross and the net profits, however, show an increase, which, with the record for the department in the make of gas per ton, is a gratifying state of affairs for the Corporation to contemplate. It will be noted that at Stafford the district rate and the free library are to benefit by the profits made by the gas and electricity departments; but that it has not been possible to add anything to the reserve fund. Only one other undertaking need be referred to now, and that is West Bromwich, where, with a substantial increase in the income for the past year, the net profit is up to quite a useful extent.

Privately Owned Railway Waggons.

It may now be taken for granted that privately owned railway waggons will not be brought into any common pooling arrangement. Mr. Runciman has been looking carefully into the matter; and he has come to the conclusion that there would be no saving or increase of efficiency by pooling privately owned waggons. This is an ending to the protest of owners, and to the controversy which the original project provoked, which will set at rest the minds of those judicious ones who had provided themselves with means of coal and other goods conveyance in days of less pressure than exists at the present time. Regarding the pooling plans brought into operation between the Great Central, Great Eastern, and Great Northern Railway Companies, and also between the Great Western, Lancashire and Yorkshire, London and North-Western, Midland, and North-Eastern Companies, Mr. Runciman understands that in all cases the result is satisfactory. Similar arrangements will shortly be in force between the Caledonian, Glasgow and South-Western, and North British Companies.

"Field's Analysis" for 1915.

Though in outward look just the same year by year, the volume universally known as "Field's Analysis" has not, of course, during the whole of the period covered by its forty-seven annual issues owed its appearance to the same industrious worker. As is indicated by the title, this analysis of accounts of the principal gas undertakings in England, Scotland, and Ireland was originally compiled and arranged by the late Mr. John Field, of the Gas Light and Coke Company. His work in this connection, which has proved of so much service for purposes of comparison to all who are associated with gas-works administration as well as to experts when appearing before Parliamentary Committees or in arbitration proceedings, was subsequently taken up by Mr. William Blakey. Now, unhappily, he, too, is dead; and on the opening page of the issue for the year 1915 [receipt of a copy of which we have to acknowledge], appears the name as compiler of Mr. Herbert Edward Ibbs, who is Mr. Blakey's successor as the Accountant to the Gas Light and Coke Company. Of the tables themselves, it may be said that the towns dealt with are the same as on the last occasion, while the price of the book is also unaltered, at 17s. 6d.

THE INSTITUTION OF GAS ENGINEERS.

MEETING TUESDAY, JUNE 6, 1916.

THE PRESIDENTIAL ADDRESS DELIVERED BY

Mr. JOHN YOUNG, of Hull.

Gentlemen,—I must thank you again for the great honour you have conferred on me in electing me as your President. I must also tender my apologies to the Presidents and members of the District Associations. I had looked forward to the pleasure of visiting each of the Associations at least once during my year of office. Unfortunately, I have not been able to attend any meeting. I felt my duty demanded as constant attendance at my works as I could give, and, except in a few cases of urgent necessity, I have not been absent from home for a single night. I beg the various Associations to believe that my enforced absence was a keen disappointment to me.

The Late Sir Corbet Woodall.

Most of the problems which have exercised our minds during the past year are referred to in the report of the Council, and I do not propose to waste your time by a recapitulation of them. To one part of the report I must refer. You will notice that the Great Reaper has taken sixteen of our friends; and we mourn their loss to day. I hope you will forgive me for referring more particularly to our most recent loss. Sir Corbet Woodall stood for all that was highest and best and noblest. I need not remind you of his great abilities. Our profession was honoured by his association with it. His strong, yet sympathetic nature gained him the affection and esteem of all who knew him; and those who knew him best admired him most. I had the privilege of being associated with him during nearly the whole of my business career, and, in common with all who served under him, I mourn the loss of a very true friend. As a token of respect for those whom we have lost, and, in sympathy with those who mourn, I ask you to rise in your places.

Gas Engineers and Coal Conservation.

In the midst of the gigantic struggle in which we and our gallant Allies are engaged, it is difficult to concentrate one's thoughts on a retrospect of our work in the past or on a forecast of our probable future development. Day by day some new anxiety, some new problem, has to be grappled; and each new development of our effort, each difficulty overcome, renders us perhaps a little forgetful of the successes of the past and the thankfulness which ought to be ours. Fortunately it has also the effect of preventing us from dwelling too pessimistically on the future. The successes of to-day give encouragement for the hope that to-morrow's difficulties will also be successfully negotiated. It is a truism that a man who, by the use of his knowledge and ability, can to the greatest extent enhance the value of raw material, is a benefactor to his country. Viewed from this standpoint, the gas engineer should rank high in the estimation of his fellow countrymen. Prior to the war, every ton of coal used by the gas engineers was at least trebled in value. There is no other industry in which coal is used in which the potential energy of the coal is so largely conserved. We are a long way from perfection in this conservation of energy; but I claim that more practical results have been attained in this direction in the past by gas engineers than by any other profession, and it must be constantly before us in the future to improve our working in this respect. Coal is the life of the country, and the industry which can obtain the greatest energy from its use is the industry which will live the longest and thrive the best. The gas produced gives excellent service, whether used for the production of light, heat, or motive power. The coke is a smokeless fuel the efficiency of which is not yet fully recognized by the public. The ammonia has considerably increased the foodstuffs producing power of the world; and the tar products are put to an almost endless variety of uses. It is a matter of regret that so many tar products were allowed to enrich the enemy.

The Industry and High Explosives.

To-day the country is dependent to a very large extent on gas engineers for its supply of high explosives. The extraction of benzol and toluol from gas has been a problem that engrossed the attention of every gas engineer. Many processes have been suggested, with all of which you are quite familiar. It is not desirable to describe or discuss the merits or demerits of any particular system, nor do I intend to describe all the methods that have been adopted. I am, however, proud to tell you that the output of benzol and toluol has become more and more satisfactory, and should encourage us to increase our efforts in this direction. It gives me great pleasure to read a letter which I have received from Lord Moulton:

> Dear Mr. Young,—I am advised that you will shortly be delivering an address to the Institution of Gas Engineers. May I take the opportunity which thus offers itself of expressing, through you, to the engineers and managers of the various gas companies forming your Association, my gratitude for the valuable assistance and loyal co-operation which the department under my control has received from them. From the commencement of the war, your members have not spared themselves in their endeavours to furnish the various raw materials required for the manufacture of our main high explosives. Their efforts have never slackened, and I am satisfied that until the cessation of hostilities I can look to them for renewed effort in the task which lies before us of not only satisfying our own demands, but giving valuable assistance to our Allies.

In pre-war times the production of benzol and toluol had not presented itself as a commercial proposition to the average gas engineer. The quantity produced per ton of coal carbonized under ordinary working conditions and the comparatively low prices obtainable were not of sufficient importance to attract attention. Occasionally it would be pointed out that if the whole of the benzol were washed out of the gas produced in the United Kingdom, the resultant quantity would be a considerable national asset. The adherence of our legislators to an illuminating power standard precluded the possibility of any serious attempts being made to recover this valuable coal gas constituent. Necessity knows no law, and the necessity of the country has enabled the gas consumer to discover that an illuminating power standard is not a necessity, and that if he obtains gas of a sufficiently high calorific value he is quite as well served for all practical purposes as he was under the old conditions. If we can also show that the supply of a debenzolized gas will eventually enable us to supply gas at a lower cost, he will be more than reconciled to the change. I think it very probable that legislation abolishing the illuminating power standard will be one of the results of our present experiences.

Debenzolizing Gas after the War.

Now the question arises, Will the debenzolizing of gas pay after the war is over? I most certainly think it will. It will be in the memory of many of you that about thirty years ago several installations of carbonizing plants were erected in colliery districts for the purpose of carbonizing cheap slack for the residual products only. These were in operation successfully for some years; but eventually prices of residuals fell, and the process was abandoned. It would be natural to say, Will not the same thing happen again? I think not. Our conditions are totally different. In the case of the carbonizing works, most of the gas produced was used for fuel in the carbonizing plant; the rest was wasted. The coke produced was necessarily of an inferior quality, and was almost unsaleable. In our case, however, gas and coke are our principal means of revenue, and any enhancement of the value of other residuals is a clear gain. The process used by the carbonizing plants was quite simple. The gas produced was cooled, washed in heavy oil (creosote or green oil), purified from ammonia, and burnt in the retort-settings and under the steam-boilers; the surplus gas, as I said before, being wasted. The heavy oil was distilled for benzol and toluol, and returned to the washers. The

washers which were found most effective were of a modified Livesey type, and two or more were usually run in series.

The Dye Industry.

Before the war most of us believed that we were conducting our business on the most economical and sound lines. Every care was exercised to prevent waste at every point of the process; and the prices obtainable for residuals warranted us in supposing that supplies were just about equal to the demand. The war, however, has rudely shaken many of our preconceived ideas. It is not only in our business that an awakening has taken place. Look, for example, to the great dye industry. Though the discovery of the manufacture of dyes and colours from coal-tar extracts was made in this country, the manufacture of them had become monopolized by the enemy, and practically the whole of the coal-tar products produced in this country was being shipped abroad. Having regard to the close connection there is between the manufacture of artificial dyes and high explosives—the fundamental raw materials being the same in each case—it is not too much to say that every dye manufactory in Germany could be, and probably was, converted into a manufactory of high explosives in a remarkably short period of time. It was also a serious thought for this country that we had not only lost our grip on a wealth-producing industry, but allowed the country to be denuded of the means of defence.

An interesting speech was made by Mr. Milton Sharp at a recent meeting of the Bradford Dyers' Association. After pointing out the relationship that exists between the production of aniline dyes and the future protection of the country due to an enlarged capacity for the production of high explosives, he asked whether all the work that had been done, the money spent, and the plant erected for the production and working-up of these raw materials were to be sacrificed when hostilities ended. I do not think they will be. The general trend of thought in the country to-day is to hold on to what we have got, and to reach out further for extensions in trade in all directions. Recently, in the House of Commons, Mr. Chamberlain gave a very clear intimation of the attitude which this Government has found itself constrained by the logic of facts to adopt. He declared that all sections would agree that, after the experience of this war, we could not leave the work of reconstruction of our trade to chance, and could not maintain a policy of complete *laisser faire* free from Government interference or assistance. He declared that the "pivotal industries" must enjoy Government help and support if their continued existence was to be ensured. He was also in favour of the maintenance, through the same means, of new industries which have been lately established so far as they were necessary to the full life and vital strength of the nation. If such a new and constructive spirit is to guide the deliberations of our statesmen on the economic safeguarding of the trade of the nation, we can rest assured the demand for home-produced benzol and toluol will be permanent.

This brings us back almost to our starting point, which was "Will the debenzolizing of gas pay after the war is over?" I hold that there can be no doubt that it will. A second point will also arise, and that is "Which will give the best financial results—the production of a high benzol yield with some loss in the volume of gas produced, or the sacrifice of residual products returns in straining after the highest possible yield of gas?" This is a question upon which no definite decision can now be given. The future of residual products is in the "lap of the gods." The answer to the question will be for each individual engineer to decide according to his environment. I mention it now, because if it should be found, as I feel it may, that the production of benzol will have a strong bearing on the economical production of gas, it will demand considerable research into the conditions of carbonization. Perhaps you are aware that, with the assistance of my good friends, Mr. Charles Wood and Mr. Thomas Hardie, I am in charge of the district comprising Yorkshire, Durham, and Northumberland. The results of the analyses of tars from the gas-works in this area has led me to the conclusion that the best benzol and toluol results are obtained in works where horizontal retorts are in use in which the coal is carbonized in thin layers and at a medium temperature. In this connection, it is interesting to remember that the carbonizing works of thirty years ago found that the adoption of inclined retorts considerably reduced their benzol yield. An investigation into the conditions of carbonizing best suited for the economical production of both gas and benzol may be one of the results of the war.

Coal Supplies.

The question of coal supplies is a very serious one. You will have noticed in the report of the Council that the last published letter from the Board of Trade advises that the coal producers and coal consumers should endeavour to come to an amicable understanding; but if there should be any fighting, the Board will be pleased to act as referee. The matter was not allowed to rest there. The Prime Minister himself has been approached; and I am assured that several Governmental departments are giving their attention to the question of such a control of coal supplies as shall be in the best interests of the Nation. At the same time, it may be well for us to look carefully at the present condition of affairs. It cannot be denied that the output of coal has suffered severe diminution. The prices that can be obtained for coal for export are very much higher than those ruling in the home market; and the temptation to the coal producer to sell as much as possible in the highest market is great. Nevertheless, I think that there are certain points in our favour which ought not to be overlooked.

In all my coal dealings I have not yet discovered any ogres among the coal producers. My experience is that they are upright and honourable gentlemen—very keen sellers, it is true, that is their business, but sound business men, with a keen eye on the future as well as on the immediate present. David Harum says: "The's as much human nature in some folks as th' is in others, if not more." The coal producer is not likely to throw over the friendly business relations of many years' standing for a temporary advantage. He knows quite well that we shall be consumers of gas coal when the present unnatural conditions have passed away; and I have faith that the probity and acumen of the coal producer will induce him to do his utmost for his old friends. I am glad to add that some evidences of this desire have come to my notice quite recently. I have heard of several contracts being renewed quite amicably and on what, under present conditions, must be considered, equitable terms. Nevertheless, it appears to me that if the Government could place a price-limitation on coal for export, the problem of home supplies would be considerably simplified.

Organization in the Industry.

There is one other subject mentioned in the report of the Council which I feel I must touch upon. I began by saying that I would not waste your time by recapitulating the report. I have successfully avoided most of the subjects mentioned therein; but if I had eschewed every one there would have been nothing left to say. I refer now to the last paragraph of the report relating to the organization of the industry. Six years ago, our esteemed President of that year, Mr. J. W. Helps, in his very able address, asked the question, Is our Institution fully representative of the gas industry? and answered that in his opinion it was not, and he favoured the idea of forming a Gas Institute divided into sections as is done with the British Association. His suggestions were afterwards discussed by the Council of the Institution; but the impending formation of the British Commercial Gas Association decided the Council to adopt a "Wait and See" policy. It was felt that the "B.C.G.A." would be likely to include all the talent we were so anxious to obtain. At the same time it was felt that our new baby should not be hampered in any way; and it was hoped the success of the new Association, which we all desired and most earnestly worked for, would in time warrant the revival of Mr. Helps's scheme. The splendid co-operation of the Society of British Gas Industries also gave hopes that a more powerful fight could be offered to any enemy when all our forces were united. The late Mr. Edward Allen, with his keen business instincts, endeavoured to gather the three Associations into a united whole; and his efforts produced the formation of a National Gas Committee, composed of twenty-one members—seven members from each Association. This Committee was to deal with all matters of importance to the industry at large, and such matters could be referred to it by any of the three Associations. Unfortunately, the war so disorganized everything that I believe the existence of this National Gas Committee was forgotten. Gas administrators rushed to first one Association and then to another to obtain advice and help. Each Association appealed to felt in duty bound to exert itself on behalf of the applicant, with the disastrous result

that to-day Governmental departments, and even Trade Associations, are at a loss to know what Association does really represent the gas industry.

Up to the present time the Institution of Gas Engineers is looked upon as representing the gas industry; and I feel sure that if all the questions that have arisen, all the appeals that have been made, had been presented through the Institution, better results would have been obtained. To-morrow there is to be a combined conference on this subject; and having in view the fact that the object of each Association is the strengthening of the position of the industry as a whole, there cannot be any doubt that a good working arrangement will be arrived at.

Daylight Saving.

The Daylight Saving Bill has become a *fait accompli;* but it is impossible to say just how it will affect the purveyors of artificial light. I am of opinion that it will make very little difference, if any. The only effect that I can see up to now is that the poor children who have to make the street their playground are robbed of an hour's sleep. They appear to run about until it is dark just as they used to do; but they have to get up an hour earlier in the morning. I do not think that this is altogether good. Sleep is very necessary to the growing child. I am aware that in well-regulated households the hours of retirement will be enforced as usual; but it will surely emphasize the plaint of the child as related by Robert Louis Stevenson:

In winter I get up at night
And dress by yellow candle light;
In summer quite the other way
I have to go to bed by day;
I have to go to bed and see
The birds still hopping on the tree,
And hear the grown-up people's feet
Still going past me on the street.
And does it not seem hard to you,
When all the sky is clear and blue
And I should like so much to play,
I have to go to bed by day?

The Benevolent Fund.

Following the example of most of my predecessors, I call your attention to the Benevolent Fund. The present income of the fund is not sufficient to meet the urgent cases brought to the Committee's notice. Many of our brethren are quite unable to make provision for those dear ones they must leave behind; and this is not due to any fault of their own. We must all know cases where honest, hard-working, striving men are so placed that they cannot provide. In other cases, the bread-winner is taken away suddenly before there has been time for provision to be made. Just think of the help given to a poor young widow with perhaps a family of young children—think of the relief given to poor old age; and then think of your own contribution to the fund. I do not only ask for new subscribers, although the Committee will be grateful to receive as many new names as possible, but I also beg every present subscriber to reconsider the amount of his annual subscription; and I feel sure that the result will be that the Committee will have an increased power of alleviating distress.

The War.

When I exchanged greetings with our most esteemed colleague, the President of the Société du Gaz en France, I ventured to express the hope that, during our respective years of office, we might have the gratification of welcoming an honourable and lasting peace. Unfortunately, these wishes were not realized. The war has cast a great shadow over the whole land, and, whether we willed it or no, has more or less tinged every thought and action. Let us be thankful, however, that the shadow is not all dark. It is true that our staffs are depleted to below safety limit; but, even so, let us rejoice in the courage and patriotism which have led our brave fellows to offer their lives to their country. Let us be deeply grateful for the magnificent fighting power and patient courage of our soldiers and sailors, our stalwart sons of the Empire, and our gallant Allies. Gratitude, however, is not enough. We who are left at home must do our share without a murmur. Each day brings with it its inevitable loss in blood and treasure, and each day we must see to it that we add to our grim determination to see this thing through to the end. The men and women of the Empire have shown that the old indomitable fighting spirit is as virile to-day as in the days of yore, when our forebears handed down to us, through blood and tears, the glorious heritage of a free-born Englishman. We have been celebrating the tercentenary of our greatest poet, and a few words of his seem to me to be an appropriate call to us in these strenuous times:

Once more unto the breach, dear friends, once more;
Or close the wall up with our English dead!
In peace, there's nothing so becomes a man
As modest stillness and humility.
But when the blast of war blows in our ears
Then imitate the action of the tiger;
Stiffen the sinews, summon up the blood,
Disguise fair nature with hard favor'd rage:
Then lend the eye a terrible aspect;
Let it pry through the portage of the head
Like the brass cannon; let the brow o'erwhelm it,
As fearfully as doth a galled rock
O'erhang and jutty his confounded base
Swill'd with the wild and wasteful ocean
Now set the teeth, and stretch the nostril wide;
Hold hard the breath, and bend up every spirit
To his full height! On, on, you noblest English
Whose blood is fet from fathers of war-proof!
Fathers that, like so many Alexanders,
Have in these parts from morn till even fought
And sheathed their swords, for lack of argument.
Dishonour not your mothers; now attest
That those whom you call'd fathers did beget you!
Be copy now to men of grosser blood,
And teach them how to war! And you, good yeomen,
Whose limbs were made in England, show us here
The mettle of your pasture; let us swear
That you are worth your breeding; which I doubt not;
For there is none of you so mean and base,
That hath not noble lustre in your eyes.
I see you stand like greyhounds in the slips,
Straining upon the start. The game's afoot;
Follow your spirit; and, upon this charge,
Cry—God for Harry! England! and Saint George.

GAS CONSUMPTION IN GERMANY.

Communications from the Central Gas Publicity Bureau of Germany to recent numbers of the "Journal für Gasbeleuchtung" give the statistics collected by the Bureau of the production by German gas undertakings for the months from October to January last. [For the similar figures for some months prior to October last, see "Journal," Vol. CXXXIII., p. 139.]

The number of works to which the figures for each month refer, and the increase in consumption as compared with the corresponding month of the two preceding years for the same works, are as follows:

Month	October, 1915.	November, 1915.	December, 1915.	January, 1916.
Number of gas-works	883	901	832	821
Increase of production over same month of 1914-15	Per Cent. 15·3	Per Cent. 11·8	Per Cent. 11·3	Per Cent. 7·1
Increase of production over same month of 1913-14	2·6	2·4	1·4	0·06

It will be seen that the decrease in production which set in after the outbreak of war has been recovered in recent months, and the output of the corresponding month prior to the war is now equalled or slightly exceeded. The natural increase of production in normal times would have been between 5 and 10 per cent. per annum, or at least 15 per cent. in two years. Actually a decrease in recent months has been averted only owing to the great increase in the number of consumers, of which the following figures for the month of December give an example: The number of ordinary meters supplied from 576 works was 5·4 per cent. more than in December, 1914, and 8·8 per cent. more than in 1913, while the number of prepayment meters supplied from 477 works was 12·2 per cent. more than in December, 1914, and 42·7 per cent. more than in 1913. In addition, many works are now supplying their small consumers without meters at a fixed charge per burner per month.

In analyses of producer gas the carbon monoxide is generally absorbed by ammoniacal cuprous chloride. In the "Chemiker Zeitung" of May 10, Fritz Hoffmann points out, however, that this absorption is never complete, and that it has in practical working remained below the real value by as much as 4 per cent. As the error would affect the other percentages, he suggests to check the result, whenever possible, by complete combustion tests. This would be laborious; but a thoroughly reliable absorbent for carbon monoxide is not known.

PERSONAL.

Mr. R. S. GARDINER has been elected Chairman of the British Gaslight Company, Limited, in succession to the late Sir Corbet Woodall. Mr. Gardiner joined the Board in the year 1900, and has thus been a Director for sixteen years.

In the list of Birthday Honours, we are pleased to see included among the new Knights the name of Mr. GEORGE THOMAS BEILBY, F.R.S. Mr. Beilby is a well-known chemist and inventor, and has specially studied fuel economy. He has rendered service to the Admiralty as a member of the Central Committee of the Board of Inventions and Research, and in other ways.

Mr. E. ROLLINGS, who has relinquished his position as Superintendent of the Basford Gas-Works of the Nottingham Corporation, in order to take up an appointment as Chief Engineer and Manager to a firm of chemical manufacturers in Yorkshire and Lincolnshire, was on Tuesday last the recipient, from those with whom he had been associated for many years in Nottingham, of a handsome barometer; Mrs. Rollings being presented with a case of fish knives. The late Superintendent had been employed at the Eastcroft and Basford works for 23 years, during a period of the greatest expansion of the city's gas undertaking; and the presentation proceedings evoked hearty expressions of appreciation of the very cordial relations subsisting between him and the various sections of the employees. The gifts were tendered on behalf of the subscribers by the foreman at the Basford works—the largest carbonizing and distributing centre in Nottingham.

OBITUARY.

THE LATE SIR CORBET WOODALL.

WRITING in the "Co-Partnership Journal of the South Metropolitan Gas Company," Mr. W. T. Layton, the Editor, says:

The passing of Sir Corbet Woodall severs one of the few links which connect us with days which are rapidly becoming "as a tale that is told." The early seventies, when George Livesey, of Old Kent Road, Robert Morton, of Nine Elms, and Corbet Woodall, of Vauxhall, used to meet and discuss the possibility of reducing Sunday labour and otherwise improving the condition of workers, seem far removed from the present time, and suggestive of plant, buildings, processes, and results which we are almost unable to picture to ourselves. Sir Corbet Woodall, who was a well-known gas engineer in the days of iron "batswings" and "fishtails," lived to administer the affairs of the Gas Light and Coke Company during the evolution of modern gas illumination, and to take an important part in the adaptation of that great undertaking to the conditions of twentieth-century life. Immediately after the death of Sir George Livesey, it was decided to introduce co-partnership among the workers of the Gas Light and Coke Company; and Sir Corbet Woodall came forward as an ardent advocate of the principles of the dead pioneer. Now he, too, has gone to rest; but he has left a notable mark on the records of the Company of which for the last ten years he has been Governor.

We are asked to state that at the funeral the Brentford Gas Company were represented by Mr. R. J. N. Neville, M.P., and Mr. William King (Directors), and Mr. Alex. A. Johnston (Engineer and Manager).

Southern Association of Gas Engineers and Managers.

We are asked to state that, by the kind invitation of the Directors of the Gas Light and Coke Company, the spring meeting of the Association will be held at Beckton on Thursday, the 15th inst. Members will be received at 11 o'clock at the Beckton works, and will afterwards be shown the coal-unloading plant on the pier, the retort-houses, the pan-breeze washing plant, and the toluol extraction plant. This, it is pointed out by the Hon. Secretary (Mr. H. C. Head), will afford an exceptional opportunity to the members of the Association to see the valuable and interesting work which is being done by the Gas Light and Coke Company at Beckton; and it is hoped that a large number of members will avail themselves of the opportunity which is offered. Convenient trains leave Fenchurch Street for Gallions Station at 10.23, 10.50, and 11.23, and return from Manor Way Station, Royal Albert Dock, to Fenchurch Street at 3.34 and 4.2. It may be added that the meeting has been fixed to take place in June, as it was not possible to make arrangements for it to be held as usual in May.

Institution of Mining Engineers.—The 64th general meeting of the Institution will be held in the rooms of the Geological Society, Burlington House, on Thursday—under the presidency of Sir Thomas H. Holland, K.C.I.E., D.Sc., F.R.S. From the list of papers to be submitted, it is noted that Mr. T. F. Winmill, B.A., B.Sc., will deal with three subjects—"The Estimation of Moisture in Coal," "The Absorption of Oxygen by Coal," and "The Oxidation of Pyrites." Among papers that have already appeared in the "Transactions," but which will be open for discussion, is one by Mr. Mills, on "Gas-Producers at Collieries for Obtaining Power and Bye-Products from Unsaleable Fuel."

GAS (STANDARD OF CALORIFIC POWER) BILL.

The Text of the Measure.

LAST Thursday there was presented in the House of Commons by Mr. Pretyman, on behalf of the Board of Trade, a Bill (which was read the first time) to "authorize as respects gas undertakings the substitution of a standard of calorific power for a standard of illuminating power." The operative part of the Bill—issued the following day—is in a single clause with four subsections, as follows:

(1) Where by virtue of any Act or Order confirmed by Act of Parliament regulating the undertaking of any company, authority, or person authorized to supply gas in any area in the United Kingdom (hereinafter referred to as the "undertakers"), the gas supplied by the undertakers is required to be of a prescribed illuminating power, and the undertakers are liable to penalties in the case of the illuminating power of the gas provided by them being less than, or being less by a prescribed extent than, such prescribed illuminating power, then, on application being made by the undertakers, the appropriate Government Department may, if they think it expedient, and subject to such conditions, if any, as they consider proper, by Order—

(*a*) substitute for the prescribed standard of illuminating power a prescribed standard of calorific power;

(*b*) exempt the undertakers from penalties in respect of a deficiency in illuminating power, and substitute for the provisions imposing such penalties provisions imposing penalties in the case of deficiency in calorific power; and

(*c*) substitute for the provisions as to testing for illuminating power provisions as to testing for calorific power;

and on the making of such an Order the Special Act or Order regulating the undertaking shall have effect as amended by the Order.

(2) In considering the expediency of making such an Order, the Department shall have special regard to whether the undertakers have erected and worked, or are prepared to erect and work, suitable crude benzol recovery plant for the production of benzol and toluol.

(3) Before making an Order under this section, the appropriate Government Department shall require the undertakers to give public notice in such manner as the Department may consider best adapted for informing persons affected of the application for an Order under this section, and of the calorific standard proposed to be adopted, and as to the manner in which, and time within which, objections may be made, and shall consider any objections which may be duly made, and shall, where they think it expedient to do so, hold an inquiry, and the costs (if any) incurred by the Department in connection with the inquiry shall be borne by the undertakers.

(4) For the purposes of this section the "appropriate Government Department" means—

(*a*) in cases where the undertakers are a local authority, the Local Government Board or the Secretary for Scotland, or the Local Government Board for Ireland, as the case may be; and

(*b*) in any other case the Board of Trade.

THE FRENCH PROFESSIONAL SYNDICATE OF THE GAS INDUSTRY.

Annual Report—War-Time Gas Conditions in France.

THE "French Professional Syndicate of the Gas Industry" has just published its report for the year 1915, adopted at the annual meeting held on April 6 last. It is a record of administrative work of the highest importance alike to the industry and the nation, covering diverse and most difficult problems, and carried out by the Syndicate with extreme energy and ability, and with a highly-developed sense of the responsibility thrust upon it by the national circumstances.

The text of the report so fully reviews the conditions of the gas industry in France during 1915 that we must refer to it again in a subsequent issue. But here we would signalize the directions in which the Syndicate has rendered specially valuable services in supporting the gas industry with its technical and commercial knowledge, in bringing the claims of the industry to the notice of the authorities, and in co-ordinating the resources of the gas profession with the united effort of France in the prosecution of the war. The report represents the superiority of organized action over individual activity. Action has been taken in regard to the supply of coal, to the recovery and utilization of tar, the extraction of benzol and toluene from gas, and (in the purely commercial sphere) to the revision of contracts seeking to enforce a stipulated price of gas, and, lastly, to the reparation of material damage occasioned by the war.

The coal question has naturally been the most insistent and pressing problem. The Syndicate's statistics put the consumption in French gas-works at 5½ million tonnes, of which, before

the war, 58 per cent. was derived from English and 42 per cent. from French coalfields. Of the French supply, three-quarters came from the Nord and Pas de Calais—now in German hands. Thus it is not remarkable that, as the result of the war, 80 per cent. is now derived from England. Of coal for other industries and for domestic use, the supply from England has been increased by 43 per cent. The report deals with the methods which the Syndicate has urged for relief from the prices of from 90 frs. to 160 frs. per tonne, as compared with 20 to 25 frs. before the war. The Syndicate has to confess with regret that its representations to the Government have so far fallen short of the relief expected or desired; but the report is, of course, prior to the fixation of coal prices by the British Government.

As regards the labour difficulty, the report states that in April of last year the normal effective of skilled labour had been reduced to some 4 per cent. The Syndicate has taken all possible steps with the War Department for the retention of indispensable employees.

In the matter of claims for exemption from military service of indispensable employees, the Syndicate is able to report the satisfactory concessions granted to gas undertakings by the Ministry of War. The advantage taken of these latter has been on as moderate a scale as possible—a policy of discretion which has further contributed to the friendly relations between the Syndicate and the War Department.

A further relief has been secured by the Syndicate in the official fixing of a minimum price of tar at 35 frs. per tonne—a figure representing a compromise between the interests of gas makers and tar distillers, and designed as a means of regularizing the complete employment of all tar for the supply of products required for the manufacture of explosives.

The tar question has been the subject of supervision by a Special Board, in collaboration with the Central Committee des Cokes Françaises, by whom the able services of M. Décluy were placed at the disposal of the Syndicate. M. Laurain, the President of the "C.C.C.F.," has also rendered signal services upon this Board, which towards the end of 1915 was able to secure more advantageous terms from the distillers as the result of representations to the War Department and through the personal conferences of M. Mallet with the distillers.

Similar organization has been applied to the extraction of benzol and toluene from gas in quantities of 5 kilos of benzol and 1·4 kilos of toluene per tonne of coal distilled. The Syndicate acknowledges the benefit secured by a visit paid to England by a Committee appointed by the French War Office, and reporting the very slight reduction in calorific, lighting, and motive power sustained by the gas as the result of removing these important bye-products. The Syndicate has likewise done much in directing public attention to the fact that the benefit to gas makers from the extraction of the products rarely exceeds 1 c. per cubic metre; while the cost of coal alone is normally 7 c. to 10 c., and in present conditions 30 c. to 40 c.

Extraction of benzol and toluene from gas was first undertaken on the large scale in May, 1915, at Gennevilliers, where for some days 70,000 cubic metres per day were successfully treated. These results having proved most satisfactory, the President of the Syndicate was authorized by the War Department to extend the operation to five of the principal French towns—those of Paris, Banlieu, Lyons, Marseilles, and Bordeaux, and subsequently to Toulouse, St. Etienne, Havre, and Nantes.

Of the legal and arbitrative work of the Syndicate, the most important has been the inquiry into the need of increases in the price of gas due to the utterly unforeseen conditions created by the war. Its efforts have more or less directly led to advances of price in the case of 337 towns or districts; while the obduracy of some municipal authorities in holding gas undertakings to old terms of concession has been dealt with by taking a case—that of Bordeaux—before the Conseil d'Etat, and there securing the favourable judgment already detailed at length in the "JOURNAL." The Syndicate very promptly brought this judgment to the notice of all its members, for their support and guidance in similar inequitable circumstances.

It is satisfactory to note that the Syndicate's activity in these different spheres has obtained the most practical testimony—viz., a notable accession to its membership to the number of 56, representing 102 works and a population of 1,700,000. Of the 802 works in France, excluding districts in enemy hands, 556 are now included in the Syndicate, equal to a population of 15½ million out of 18 millions.

The financial statement reveals an expenditure of 11,000 frs. over the receipts, due to exceptional legal and propagandist outlay. This deficit has prompted the doubling of their subscriptions by two generous members; but it is proposed to supplement the Syndicate's resources by an additional demand for 1916 at the rate of 3 frs. per thousand of the population in the district of each gas undertaking.

Association of Gas and Water Engineers of Austria and Hungary.—It is announced that the annual meeting of this Association was held at Vienna last Friday and Saturday. The programme included, in addition to private business, a discussion on the "Effect of War Conditions on the Position of Gas and Water Works," and the presentation of a number of technical papers of which particulars will be given shortly.

SUCCESSFUL WORKING OF TAR DEHYDRATION PLANTS FOR THE RECOVERY OF THE RAW MATERIALS FOR EXPLOSIVES.

By H. O. CARR and U. O. S. NAIRNE.

Now that tar dehydration plants, designed to work at atmospheric pressure, have come so much into vogue for the partial distillation of tar for the recovery of benzol, toluol, naphtha, and carbolic oils, a few remarks in regard to them may be of use to those who have experienced working difficulties.

Usually the heat from the furnace is conducted through a number of horizontal tubes in the bottom part of the still, while the tar is caused to flow through the still around these tubes in various directions by means of baffles. In some of these plants the tar flows during half its travel through the still in a direction contrary to that of the furnace gases, and for the remaining half travels in the same direction as the furnace gases. In others the tar enters the cold end of the still, and progresses backwards and forwards across the tubes until it finally leaves the still at the hottest or furnace end.

In many cases the plants erected have been most inadequately fitted as regards condensing power, so that in some cases the benzol, toluol, and solvent naphtha could not be condensed at all; the amount of tar passing through the condenser being too small to condense the vapours distilled from the tar when heated to a sufficiently high temperature to recover the bulk or all of the carbolic oils. Where this occurs, advice is unfortunately given that water should be substituted for tar as the condensing medium in the condenser. This unfortunate advice—especially so, as being given during war time—creates several sources of waste. The condenser is designed and specified to use the incoming cold tar as the cooling agent; and in this process the tar is raised considerably in temperature. But, if water is substituted for cooling the vapours in the primary coil, the tar does not acquire the initial temperature which it should do, with the result that in many cases the furnace may not be powerful enough to bring the tar in the still to the required temperature to drive off the carbolic oils, which, with those distilling at lower temperatures, are all required for war purposes. Therefore this wastage of heat and water becomes a most important matter. On the other hand, it is possible that in some of the plants the furnace may be of such power as to be able to effect the distillation of the bulk of the carbolic oils. At the same time, through the tar not having been raised in temperature in the primary condenser, but only having passed through the heat interchanger to be heated by the tar leaving the still, the fuel required in the furnace is nearly double that actually required if the plant were working efficiently.

This form of plant, therefore, should be worked so that the tar is the cooling agent in the primary condenser; and an efficient water-cooled condenser should be added in series, to condense the lighter oil vapours uncondensed there. Much less water will be required for condensation than would be the case if tar were not used primarily. With this arrangement it has been proved that this form of plant can perform the required duties, and has further distinct advantages, in that two grades of oil are obtained and can be run into separate storage tanks. The condensate from the primary tar condenser consists of weak liquor, light creosote and carbolic oils and a fair amount of naphthalene; but, owing to the temperature of the condensate being high, no blockages caused by the naphthalene can occur, as sometimes happens if only cooling by water is relied on. The condensate from the secondary or water-cooled condenser consists of benzol, toluol, solvent naphtha, strong ammoniacal liquor, and very little naphthalene, all of which have escaped condensation in the tar condenser owing to the high temperature to which the tar is raised therein by the vapours. The oils recovered in the water-cooled condenser are worth double the market value of the oils from the tar-cooled condenser.

These facts make it quite clear that any gas undertaking which has had one of these plants erected under guarantees should insist upon the secondary water-cooled condenser being supplied; or where they have no such guarantees, or have erected the plant themselves, they should at once instal a secondary condenser, which is very simple in design and easily made, and usually consists of about five 2-inch tubes arranged as an ordinary vertical tubular condenser—the tubes being surrounded with water.

For efficient working, these plants require to be worked with the greatest regularity—the tar flowing at the best rate to suit the plant, in order to yield the products required; and care must be taken that the still tubes are never allowed to become choked with flue dust.

If the resultant tar is too thick to run from the barrels on cooling, a small percentage of creosote or carburetted water-gas tar can be added to the hot tar as it leaves the still, until the required viscosity is obtained.

If the advice given is followed, it will be found that the dehydration plant will be highly successful both in regard to its working and its financial results.

It has been decided not to hold this year the summer meeting of the Institution of Heating and Ventilating Engineers.

ELECTRICITY SUPPLY MEMORANDA.

THE Coal and Coke Supplies Committee are still intent on securing a larger surplus of coal from which coal owners may make a bigger profit by exporting it than can be realized at home; and they still hold to the view that their charitable act can best be achieved by finding out the places where, in their imagination, there can be economy in coal use at home. Of course, the Committee have never made any admission that they are acting directly in the interests of the coal owners. But they must recognize that this is the indirect effect; and their concern is gleefully welcomed by the coal people. The grounds upon which they profess to be solicitous to release more coal for export are that the revenue from an increase of exports is badly wanted, and that coal is a desirable lever in negotiations with neutral countries. "Charity begins at home;" and the additional coal which it is hoped to secure for export to neutral countries, and which would be sold by the coal owners at a higher price than rules at home, can be well employed in this country for the production of our own necessaries or of goods for export. The electricity industry had, like the gas industry, the now famous and much criticized circular as to the 10 per cent. reduction in coal used for the provision of lighting; and now they have another remarkable suggestion from the Board of Trade, who have again been advised by the extraordinarily wise Coal and Coke Supplies Committee. The Committee have called the attention of the Board to the "considerable saving that could be effected by the adoption of arrangements for interconnection and joint working of electric supply undertakings." The Board, too, "are advised that in *many* cases, the necessary arrangements could be made at once;" and they are willing to assist in arranging terms and conditions under which the scheme should be carried out. We undertake to say the Board will not be worried much with terms and conditions. It is a matter that is not by any means so simple as it looks. The "Electrical Review" apparently thinks it is. It says: "The importance of this step can hardly be exaggerated, not only in its bearing upon the conditions which exist in war time, but also in its effect upon the whole future of electrical engineering in this country." Our contemporary also speaks of the economy of fuel and the release of stand-by plant, but omits any reference to the added business complication, although admittedly there is increased safety of supply. If the Board of Trade only read the "Review," they will be encouraged to press forward with the matter; if they happen to cast an eye over the criticisms of the "Electrician" and "Electrical Times," they may temper their anxiety to rush the interlinking policy. The "Electrician" has doubts as to whether the Board are fully aware of the many engineering difficulties that will have to be considered. And "Meteor" of the "Electrical Times" opines that the view that "in many cases the necessary arrangements could be made at once," will "engender a weary smile on the faces of many station engineers." This is not the only thing that during the war has emanated from Whitehall and has raised a weary smile on the faces of those responsible for the conduct of public services.

Coal Saving and Interlinking.

The Bowden Coal Economy Plan.

We really do not know whether to take seriously a letter that Mr. J. Horace Bowden, of Poplar, has addressed to the Electrical Press as to the question of the economy of coal. If he intends the letter to be so taken, then we can only characterize it as about the weakest production, so far as we have seen his writings, that has come from the pen of Mr. Bowden; and really, anyway, we are surprised at its contents coming from an engineer who understands the difference between coal carbonization for the separation of its varied constituents, and the total destruction of coal for a single purpose—such as the generation of electricity. He is writing on the question of the Board of Trade economy-of-coal circular; and he appears to be labouring under the impression that national interests would be served if the lighting of the country was completely turned over to electricity, and gas was completely snuffed out. He makes his comparison on the ground that if the whole of the electrical energy obtained from a ton of coal was utilized for lighting purposes, it would go farther in the matter of illumination than the 12,000 to 13,000 cubic feet of gas produced per ton of coal. He says nothing at all as to the value that exists in the rest of the products obtained from the carbonization of a ton of coal, and without which value many of the country's interests would be brought to a complete standstill.

The Lighting Illustration.

Mr. Bowden, in the first place, says that "a 66-candle power gas-burner will consume 4 cubic feet of gas per hour; therefore one ton of coal will supply light, under the most favourable conditions of plant and fuel, to 3250 66-candle power burners." Permit us to say that modern inverted gas-burners do not consume 4 cubic feet of gas to produce 66-candle power, which would only be equivalent to an efficiency of 16·5-candle power per cubic feet of gas. With gas of only about 500 B.Th.U. per cubic foot, the photometer would prove to Mr. Bowden that an efficiency of 20 to 25 candle power is realizable. This being so, we are able with 12,500 cubic feet of gas to secure, taking an efficiency of 20 candles per cubic foot, 250,000 candle-hours, which is equivalent to 3788 lamps of 66-candle power. Proceeding, Mr. Bowden (who presents one of the worst conditions for gas that he could have done) then takes the best conditions possible for electricity. He says: "By employing electricity as the lighting agent, *under the best conditions* of plant and fuel, not more than 3 lbs. of coal per unit of energy supplied need be consumed. Therefore, one ton of coal will produce 747 units of energy or 747,000 watts; and 11,318 *one*-watt lamps of 66-candle power each will give three-and-a-half times the light obtainable from 3250 66-candle power gas-burners." Here Mr. Bowden has taken conditions which indicate the efficiency of a modern turbine generating plant, with which the few and not the many generating stations are equipped. He must also know that the candle per watt metallic filament lamp is a fiction, and that 1-candle power per 1·25 to 1·5 or 1·6 watts is nearer the true efficiency. "By the use of the half-watt lamp," he also says, "the proportion of fuel used is one to seven." In comparison with the so-called half-watt lamp (which again is a misnomer, for the efficiency belies the name with which the lamp is endowed), why did not Mr. Bowden mention the high-pressure gas-lamp?

The Power Illustration.

Then Mr. Bowden goes on to say: "A greater field for coal economy presents itself in the use of power. *Twenty-five* feet of gas per horse power is a fairly moderate estimate for gas-engine consumption, compared with 746 watts by the use of electrical energy. One ton of coal will yield 520 horse-power-hours by the use of gas, and 1000 horse-power-hours by the use of electrical energy, which shows a saving of approximately 50 per cent. in coal consumption." Now Mr. Bowden is not generous in his comparisons. He speaks of 25 cubic feet per horse power being "fairly moderate." Running at full load, 16 cubic feet per brake horse power hour is a fairly applicable figure with modern gas-engines. There may be an increase of 1 to 4 cubic feet for engines up to 12-horse power; but from 12 up to say 20 horse power, 16 cubic feet is a fair average figure with the modern engine. It may be below that by 1 or 2 cubic feet for engines from 20 up to 60 horse power. Now the "facts" that he presents Mr. Bowden thinks should be brought before the Board of Trade, "with the assurance that every electrical engineer would readily assist the Government to bring about this enormous reduction in coal consumption, provided the Government will assist in obtaining adequate supplies of fuel and machinery to enable the engineer to achieve the desired object." We hope the "facts" will soon be introduced to the Board of Trade, because that august and much worried authority will then have something to relieve the monotony of the perpetual embarrassment from which it has been suffering since the war began.

Other Considerations Besides Gas.

Now the Board of Trade happen to know, even if an engineer of the standing of Mr. Bowden is unaware of the fact, that the gas industry does not use up a ton of coal in making 12,000 to 13,000 cubic feet of gas. There is half a ton of coke remaining for disposal, from which carburetted water gas can be made, which can be used for lighting, heating, or motive power; or the coke (which has a calorific power of about 14,000 B.Th.U. per lb.) can be employed for steam-raising for use with turbines for producing electricity or for any other purposes for which steam is required. If the Board of Trade do their duty to the country, and really desire economy of coal, it will insist upon electricity generating stations using coke (with forced draught) for steam-raising, instead of crude coal, with its value in gas, tar, sulphate of ammonia, and all else absolutely destroyed. What has Mr. Bowden to offer the country for this half-ton of coke? What has he to offer the country for the tar with its wealth of light, intermediate, and heavy oils—tar the basis of aniline dyes (of which 392 different colours and shades are listed), with its carbolic acid, naphthalene, anthracene, and benzol content, each of which in turn yields a long series of other products? The benzol yields, for instance, toluol; and both benzol and toluol are urgently required in the war. Washing the gas, too, from a ton of coal with oil, the nation receives about 10 lbs. of benzol and between 3·5 and 4 lbs. of toluol. How is Mr. Bowden going to keep the country and its Allies supplied with high explosives if the whole of the lighting custom of the gas industry is turned over to the electric industry? From the tar, too, all sorts of chemical preparations are derived—synthetic and otherwise. Then what of the 25 to 30 lbs. of sulphate of ammonia per ton of coal for fertilizing purposes? Tar has a thermal value as well as the gas and coke. Taking the total thermal value of the gas, coke, and tar, can Mr. Bowden show a process in the generation of electricity that only exhibits a loss of 3·43 per cent. of the original calorific value of the coal? Now if Mr. Bowden really wants to give a little amusement in Whitehall, especially during war-time, he had better go along there with his figures. We venture to say he will have Whitehall laughter ringing in his ears long after he reaches Poplar.

Electric Furnaces.

Spasmodically, a little information is given in the electrical papers regarding the operation of, and problems connected with, the electric furnace; but no lavishness is shown in the publication of particulars regarding first cost and expenses of instal-

lation, maintenance, supervision, running, &c. But sufficient is said to show that electric furnaces have their faults and their shortcomings. A paper recently read before the American Electrochemical Society at Washington, by Mr. W. M. M'Knight, was on the "Faults of Small Electric Arc Furnaces;" and in the course of a description in the "Electrical World" of a Heroult 1-ton electric-furnace at the works of the Lebanon (Pa.) Steel Foundry, it is stated that it is of great importance to the steel mill, as well as to the central station supplying energy, that all electrical equipment of the furnace should be inspected at definite intervals by a competent electrician. At the Lebanon Steel Foundry, a capable engineer is employed, who spends three or four hours weekly going over the equipment. "This," it is said, "is all the expert attention required during the twelve months' operation." The "all" is quite enough; and it adds to the running expenses. In Mr. M'Knight's paper, it is also mentioned that while the small electric-furnace is rapidly coming into favour for the production of small highly refined steel castings, nevertheless the over-all efficiency of the best furnaces on the market is far from 100 per cent. The principal sources of loss are: (1) The improper delivery of energy to the metal; (2) the improper design of the furnace shell and ports to exclude cold air and retain the heat; and (3) the improper combinations of refractory materials, which should be inexpensive in first cost, withstand the intense heat long enough to avoid delays through the interruption of the manufacturing process, and not introduce any chemical combination with the metal. Further, a desideratum is an electrode that will not waste away too rapidly through oxidation, within and without the furnace as it comes in contact with the air and gases.

Refractories and Electrodes.

On the question of improvements, Mr. M'Knight remarks that electrical conditions can be improved by supplying the proper current at the proper potential. Mechanical conditions can be improved by re-designing detail portions of the furnace. The chemical conditions can be improved only by exhaustive research and careful study. Merely to melt down steel scrap and turn out castings of semi-steel and low-grade castings of unknown quality does not require a temperature of 2500° C., and a lining of silica is used in furnaces made for this class of work. To refine the steel, however, it is necessary to employ a basic lining of magnesite—at least where it comes in contact with the bath, or where the heat would be intense enough to melt-down the silica, and cause it to run into the bath, and combine with the metal bath or slag and the basic lining, thereby changing their character. The electrodes are of two kinds, carbon and graphite. The carbon electrode is the less costly, but has less electrical carrying capacity than graphite, and consequently must be greater in cross-section to deliver the same amount of energy. It therefore has a larger amount of radiating surface, and consequently the saving in first cost of the carbon is offset by the loss of energy dissipated in heat. The graphite electrode, by virtue of its greater carrying capacity, is smaller in diameter, and offers less surface for radiation of heat and oxidation. The electrode within the furnace shell is subject to further attack by the passage of the electric current through the heated gases to the lining, which, at a temperature of 2500° C., itself becomes a very good conductor of electricity.

A Suitable Station Load.

Referring to the 1-ton furnace at the Lebanon Steel Foundry, "Electrical Engineering" (which reproduces particulars from the "Electrical World") remarks that at first sight an electric arc furnace would appear to be a load quite unsuitable for operation from a central station supply. Short-circuits are liable to occur at any moment during certain stages of the melting; and, in addition to this, the normal variation in load may be some 30 per cent. above and below normal rating. In the case of the 1-ton furnace, the energy is generated by the central station at a pressure of 2400 volts, three-phase, 60 cycles; and the furnace load is taken from the same bus-bars that supply a mixed load for lighting, power, and tramway. The energy is furnished by the Edison Electric Illuminating Company; and they state that the supply of the furnace is a desirable business, giving a balanced three-phase load of high-power factor and load factor, and that it can be successfully operated from a central station of moderate capacity. The Company have entered into a contract to supply a 2 ton furnace at the same foundry.

THE PATENT OFFICE REPORT.

As was remarked in a paragraph which appeared in last week's issue, one of the many effects of the war has been a considerable curtailment of the activities of inventors, as reflected by the operations of the Patent Office. How great has been the influence on the Department of the disturbed condition of affairs, is revealed by the recently issued report of Mr. W. Temple Franks, the Comptroller-General of Patents, Designs, and Trade Marks. It is the thirty-third report of the series, and covers the twelve months to Dec. 31, 1915.

The first section of the report deals with the war legislation relating to patents; and from this it appears that during the year 154 applications were made under the Patents, &c. (Temporary Rules), Acts and subsequent rules and orders. In 117 of these cases, licences have been granted, or are in course of being granted, to manufacture under enemy patents, on payment of a royalty. Upon the outbreak of war, all applications for patents filed by subjects of any State at war with this country were allowed to proceed as usual down to the time of acceptance; but formal acceptance was not issued. The result of this was an accumulation of unpublished specifications, some of which, it was felt, might be of importance to the trade of the country. Besides this, until such specifications were published, they could not be cited as anticipations of later applications. This being so, it was decided to accept and publish these specifications, but to suspend, until otherwise directed, all further proceedings thereon. The suspension of proceedings upon these applications will only be discharged upon proper terms.

Some months ago, an Order in Council was issued amending the Defence of the Realm Regulations. It is provided that, where an application has been made for the grant of a patent in the United Kingdom, and the Comptroller is satisfied that the publication of the invention might be detrimental to the public safety or the defence of the realm, or might otherwise assist the enemy or endanger the successful prosecution of the war, he may delay the acceptance of the complete specification filed with the application. In this event, he may prohibit the publication or communication in any way of the invention, or application being made for the protection of the invention in any enemy or neutral country, or in any allied country or any of His Majesty's dominions (without the permission of the Admiralty and Army Council). Another provision is to the effect that no person shall apply for the grant of a patent in any foreign country or any of His Majesty's dominions, unless he has communicated to the Patent Office notice of his intention, together with a provisional specification describing the nature of the invention, nor until after the expiration of one month from the time when such notice was given. If during the month the Comptroller is satisfied that the publication of the invention might be detrimental to the safety or defence of the country, or otherwise help the enemy, he may make the same order as in regard to cases in which application is made for the grant of a patent in the United Kingdom. The Comptroller may not, however, act except upon the request of the Admiralty or Army Council. This order, it is pointed out, has thrown much additional work upon the office.

As to the ordinary work of the Patent Office during the year, the total number of applications for patents (18,191), exhibits a very heavy falling off when compared with the previous year (24,820), which was, in its turn, a big reduction on the 30,077 applications of 1913. The past year's is the lowest number received in any one year since 1887. The applications accompanied by provisional specifications was reduced from 16,590 in 1914 to 13,242 in 1915; while those accompanied by complete specifications fell from 8230 to 4949. The proportion of complete to provisional specifications filed on application was thus only 37 per cent., as compared with 50 per cent. in 1914. This decrease, it is pointed out, is, of course, due to the continuation of the war; and in making comparisons, it has to be remembered that the figures for 1915 relate to a full year of war as against five months in 1914.

The war is responsible, no doubt, for other features also of the report. With so many new careers of usefulness open to them, women are evidently even less prone than formerly to turn their attention to inventing; for only 268 applications were received from them last year, as compared with 347 in 1914. Then, the applications made by way of communications from abroad numbered only 948, as compared with 1291 in 1914; while under the provisions of the International Convention for the Protection of Industrial Property, only 1555 applications were made in this country, as against 2909 in 1914.

Of the complete specifications filed upon applications made in 1914, 725 were reported as wholly anticipated, 8142 as partly anticipated, and 4019 as not anticipated. In 200 cases reference to a previous specification was inserted. The total number of patents which expired in 1915 was 16,662; the number of new patents sealed being 11,457. As usual, a few patents were restored which had lapsed in consequence of the non-payment of renewal fees. Two patents were revoked by consent under the provisions which empower the Comptroller to revoke a patent upon application made within two years from the date of the patent by any person who would have been entitled to oppose its grant; and in two other cases orders were made requiring an amendment of the patentee's specification. There were two petitions for extension of term; one being abandoned, and the other still undecided. There are now only three patents in force which have been prolonged beyond the normal period of fourteen years.

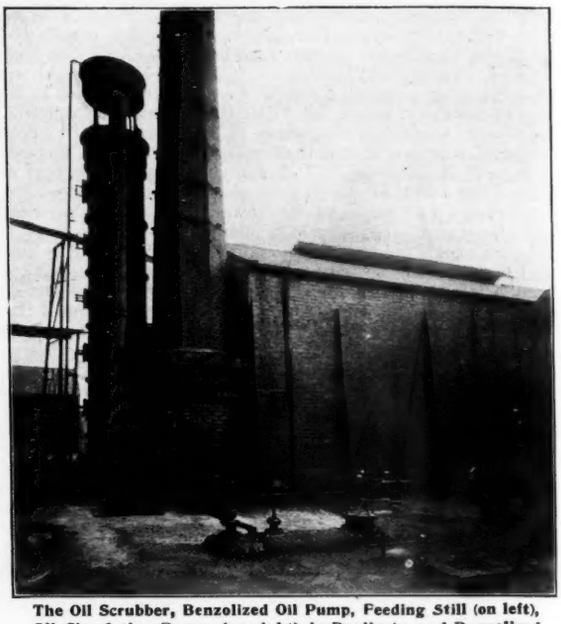
The receipts from patent fees, &c., last year amounted to £256,723, as compared with £287,118 in 1914. The renewal fees were £183,929, a decrease of £1145; and the sealing fees, £12,837, a falling off of £1844.

Masonic.—On the 23rd ult., at the Municipal Chambers, Eastleigh, Bro. Frederick Falkner was installed as W.M. of the Hampshire Lodge of Emulation, No. 1990. The new W.M. is a native of the ancient borough of Romsey, and has for many years been the Manager and Secretary of the Romsey Gas and Coke Company, Limited.

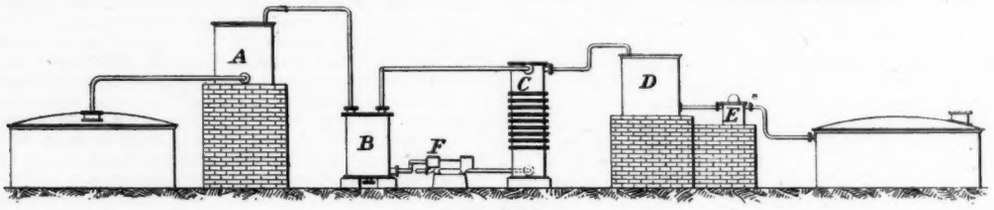
THE WOMBWELL OIL-WASHING AND BENZOL RECOVERY PLANT.

At the meeting held at Norwich (as reported in the last issue of the "Journal") for the purpose of demonstrating the advantages of washing gas with oil, in order to extract the toluol and benzol, after Mr. Thomas Glover had described his plant [*ante*, pp. 387-9], Mr. P. D. Walmsley, the Engineer and Manager of the Wombwell Gas-Works, gave an account of a plant designed by the Wombwell Engineering Company with certain modifications to adapt it to a much smaller works than those at Norwich. This description [*ante*, p. 440] we are now able, through the kindness of Mr. Walmsley, to supplement with illustrations of the arrangement.

Briefly explained, the process is as follows: Creosote oil from the tank is pumped over the scrubber, the outlet of which delivers the oil back into the tank; and thus it is continuously circulating. The oil in the scrubber picks up benzol from the gas; and for distillation a pump takes a supply from the tank, and delivers it into the still. The still disengages the benzol vapours, which pass from the head into the benzol cooler, and then into the separator, where the spirit and water are separated, and crude benzol flows out of the separator into a benzol barrel under the benzol cooler, as shown. The debenzolized oil passes from the still, through a coil of spray-pipes, where it is cooled, afterwards flowing into the debenzolized oil storage tank for use again. Debenzolized oil is taken out of this tank by a pump, and pumped over the scrubber to get it back into circulation for benzolizing again.

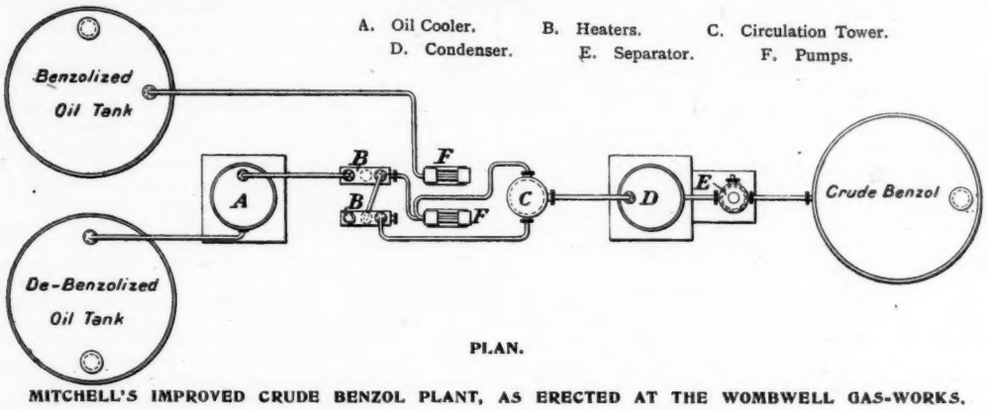


The Oil Scrubber, Benzolized Oil Pump, Feeding Still (on left), Oil-Circulating Pumps (on right), in Duplicate, and Benzolized Oil-Storage Tanks.



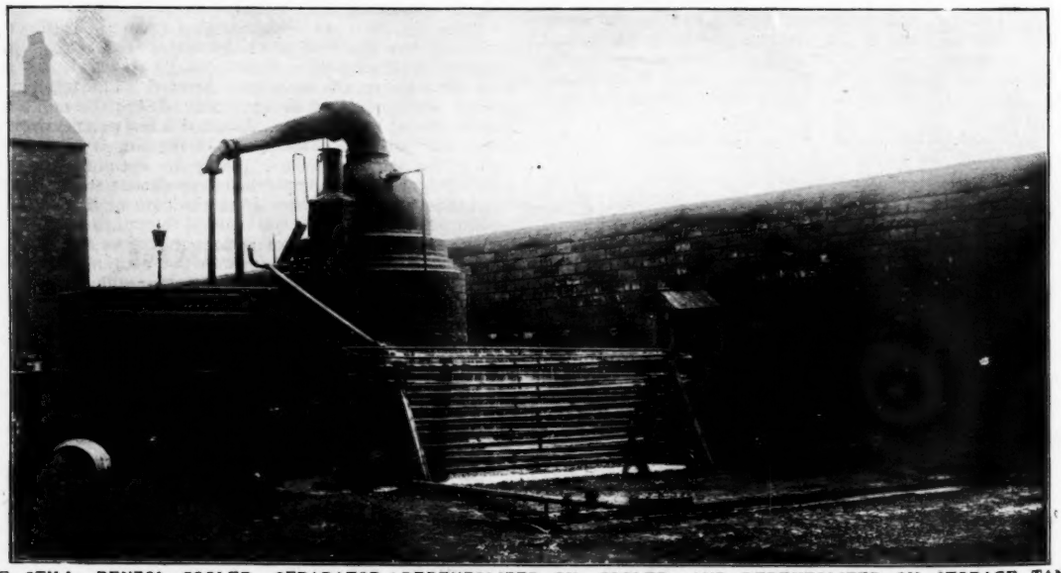
ELEVATION.

A. Oil Cooler. B. Heaters. C. Circulation Tower.
D. Condenser. E. Separator. F. Pumps.

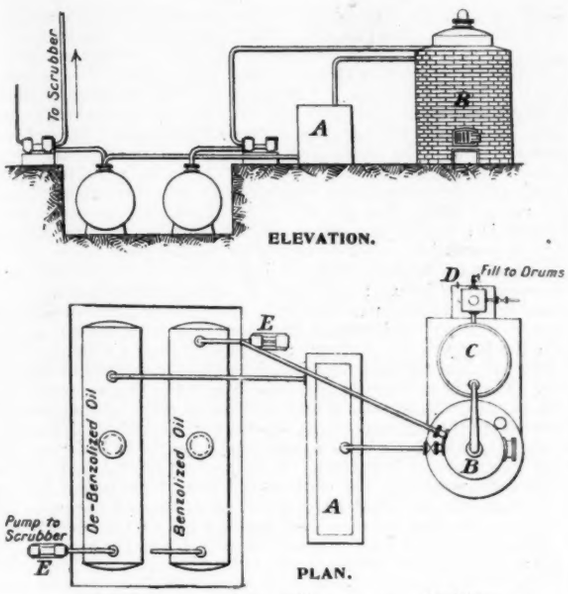


PLAN.

MITCHELL'S IMPROVED CRUDE BENZOL PLANT, AS ERECTED AT THE WOMBWELL GAS-WORKS.



THE STILL, BENZOL COOLER, SEPARATOR, DEBENZOLIZED OIL COOLER, AND DEBENZOLIZED OIL-STORAGE TANK.



A. Oil Cooler. B. Still. C. Condenser.
D. Separator. E. Pumps.

MITCHELL'S IMPROVED CRUDE BENZOL PLANT.

SULPHATE OF AMMONIA AND BENZOL.

A critical examination is undertaken by Mr. D. Bagley, in the current issue of the "Iron and Coal Trades Review," of sulphate of ammonia and benzol as bye-products of modern coke-plants, in order to determine whether any alteration in the works *modus operandi* will become politic in view of possible modifications in their respective positions. Giving particulars and diagrams of the make, exports, and prices of sulphate of ammonia over a series of years, the writer says a moderately satisfactory state of affairs is revealed, tempered by possible reduction of trade with countries likely to become less dependent upon us.

Synthetic Ammonia and Nitric Acid Production.

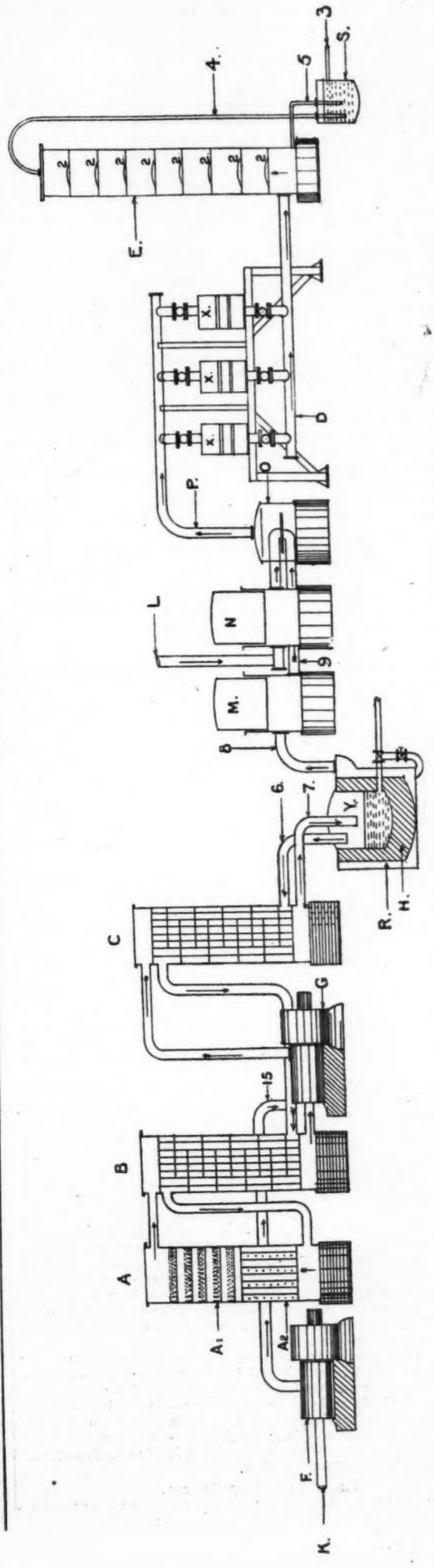
It is, Mr. Bagley proceeds, only when we come to examine the growth of certain intrusive factors in the shape of synthetic ammonia and competitive industries, that the prospective situation becomes obscure. One of the crucial factors is the Haber process for producing ammonia directly from its elements—now operated by the Badische Soda und Anilin Fabrik. The Badische Company have shown unmistakable signs of appreciation of the Haber process. *De facto*, the Haber process is one of the most economical, and is superior to other synthetic processes. It effects the direct union of nitrogen and hydrogen under high pressure in the presence of a suitable catalyst, in accordance with the equation:

$$N_2 + 3H_2 \rightleftarrows 2NH_3.$$

Heat is evolved; and it will be observed that the equation is reversible and dependent upon the equilibrium of the gases under various known phases, which may be explicitly expressed.

The illustration is a diagrammatic elevation of the process, but instead of using the obscure published matter relating to the system, Mr. Bagley says he has chosen a form of diagram which, if slightly clearer in form, must not be confused as similar to the plant actually employed. To those familiar with pressure work, and comparatively high temperatures under such novel conditions, the marked deviation from practice will be at once obvious in the diagram. The impellers, for instance, would serve a battery. For convenience, a diagrammatic elevation of the Ostwald process has been combined (which likewise must not be confused with the plant actually employed for oxidizing the ammonia to nitric acid), in order to illustrate the complete process for producing nitric acid in two stages from nitrogen and hydrogen, with the addition of oxygen in the final stage. Nitrogen—which may be obtained by the Linde or Claude processes—and hydrogen now economically produced in various ways, are mixed in the proportion of one volume of the former to three of the latter, and compressed to (according to Haber) 200 atmospheres.

The mixed gases enter the system by the inlet-tube K, and are impelled by means of the impeller F through the branch-tube 15. At this stage, the gases are at atmospheric temperature. They then enter the regenerator or heat interchanger B, and pass round a series of fine tubes, through which flow the hot gases from the contact chamber, their temperature being raised to 400° to 600° C. The gases are then led to the vessel A, which consists of two sections; the lower one, A2, containing resistance coils for elevating the temperature of the gases to the degree desired—700° to 900° C.—and the upper one, A1, containing the catalyst



DIAGRAMMATIC SKETCH OF THE HABER AND OSTWALD PROCESSES COMBINED—SYNTHETIC AMMONIA AND NITRIC ACID—PLANT.

over which the hot gases stream. The catalyst preferably consists of uranium; but there is a moderately wide range of suitable metals—such as cerium, manganese, tungsten, osmium, &c. In the section A1 the formation of ammonia occurs, varying between—so it is stated—2 and 6 per cent. of the gases passing the contacts. The hot mixed gases then pass to the regenerator B, and stream downwards through the series of fine tubes, where their heat is imparted to the incoming gases; and they leave the regenerator at a temperature sufficiently low to permit of their being impelled by the impeller G to a second regenerator C. The function of this apparatus is precisely similar to that of B, except that a lower range of temperatures within narrower limits is dealt with. The gases pass through a series of fine tubes within the regenerator, and serve to preheat the gases leaving the collecting chamber Y at a temperature of − 60° C. The interchange of temperatures must be as reasonably perfect as is permissible. The gases then pass, *viâ* the tube 7, to the collecting chamber Y, with the condensed and condensing ammonia; the chamber being fitted with a jacket containing a suitable freezing mixture, capable of reducing the temperature to from − 60° to − 70° C. [Haber states solid CO_2 and ether, ?] The condensed ammonia can then be drawn off as liquid, or may be—as depicted—expanded into a second covering jacket. The uncombined nitrogen and hydrogen pass from the collecting chamber Y at a temperature of −60° C., *viâ* the tube 6, and enter the regenerator C, being heated to above atmospheric temperature by the contra flow of gases moving through the series of tubes to the collecting chamber, and thence pass again into the first regenerator, and subsequently to the contacts. The impeller F introduces a volume of gases into the system commensurate with the ammonia withdrawn.

Assuming the Ostwald nitric process to be operated in conjunction, the ammonia would leave the outer jacket of the collecting chamber Y, *viâ* the tube 8, and pass to a regulating vessel M. A similar vessel N is fed with atmospheric air, and the ammonia and air are mixed in proper proportions (1 vol. NH_3 *plus* 10 vols. air, the latter corresponding to 2 vols. O_2) in a mixing vessel O. The mixed gases stream through the tube P to the contact chambers X, X, X. Here the catalyst consists of platinum black and smooth platinum. The equation is as follows:

$$NH_3 + 2O_2 = HNO_3 + H_2O.$$

This reaction is not final; so that some modification of the mixture has been adopted, with other devices, for preventing a valueless result. Sufficient heat is liberated to maintain the reaction; above 300° C. being the temperature desired. The gases preferably pass over the contacts rapidly. The hot gases leave the contact chambers, and pass through the tube D to the tower E, or a series of towers, in which condensation and limited concentration are, or may be, performed; the acid finally collecting in the receiver S, from which it is led to the storage tanks. The method of condensing shown is very primitive; and as weak acid has only a limited use, far more suitable means are being devised, with the object of economically producing more highly concentrated acid.

Effects of Additional Production.

Looking at the matter from a commercial point of view, and summing up the different factors, Mr. Bagley points out that it has been alleged that the total cost of producing ammonium sulphate by the Haber process is under £2 10s. per ton. At first sight, this will be regarded as a totally impossible calculation; but on closer examination it will be remarked that the process is not a complicated one, while there is a choice of suitable catalysts. Taking everything into consideration, the author's considered opinion is that synthetic ammonia, and with it certain other nitrogenous compounds now manufactured on an extensive scale, must affect the position of sulphate as derived from gas and coke works, unless some new and important outlets are found for the product.

But, proceeds Mr. Bagley, we must not forget that ammonia from the distillation of coal still remains, and promises to remain, the cheapest form; that recent research justifies the hope that the quantity per unit of coal can be increased; that the cost of the production of nitrate under improved methods of operation is well above that of ammonium sulphate; and that nitrate with other artificial forms of nitrogenous compounds—perhaps excluding the synthetic ammonia—might become unprofitable while still leaving a margin of profit to ordinary sulphate, as derived from the distillation of coal, &c. This aspect is one which should be very carefully studied. The United States is at present considering, in the light of European experience, what provision it should make to ensure an adequate productive capacity for the huge supplies of nitric acid necessity might call for; and, in the author's opinion, the potentialities of the coke-oven, particularly in view of the other equally necessary products available from the same source, provide an economic solution superior to any other project. Taking what may be termed the average values for ammonium sulphate, benzol, and tar, their respective contributions to the gross revenue of coke-works expressed in percentages are in the variable ratio of 47, 32, and 21—fluctuating with the nature of the coal distilled, values, &c. Thus ammonia at present occupies the foremost position; but it is closely followed by benzol, and the distillation of the tar produced *in situ* affords a means of enhancing its contributory effect.

The Position of Benzol.

In dealing with the present and prospective position of benzol, Mr. Bagley believes he may claim individual or joint responsibility for plant giving an annual output from home and foreign sources of nearly 15,000,000 gallons. The production of benzol and its homologues in European countries in the year 1907 was as follows: Germany, 60,000 tons; Great Britain, 25,000 tons; France, 8000 tons; Belgium, 6000 tons. A conservative estimate of the position to-day would credit Germany with an output of 160,000 tons [this excludes occupied territory]; and our own production, purely from coke-works and the distillation of tar, has attained highly satisfactory dimensions, even excluding that now being derived from illuminating gases—a most valuable source which, it is to be hoped, will remain open after the war. The huge increase in our production is a matter for congratulation. At some future date, it may be possible to assign to benzol its rightful position.

Few modern coking plants are unequipped with apparatus for the recovery of benzol; and most of the larger installations very wisely refine the products obtained. The author believes he is at once on controversial ground when touching upon the important question of operative efficiency; for this involves a consideration of plant design, and may be critical as regards method of operation. Thus he prefers to deal briefly with the general position. The operation has been, and still is, circumscribed by commercial practice and tradition, which exercise a noticeable influence on the possible yield; but "65 per cent." benzol is bad practice when every gallon is wanted. Modern plant should be capable of extracting up to 90 per cent. of the benzol contained in the gases; and the standard method of test is to cool the gases to 0° C., and employ a prescribed paraffin oil as the absorbent, equating the result from a known standard and the increase in weight. Greater exactitude is secured by distilling off from the paraffin. The possible yield referred to should represent the average of uninterrupted operation, and is not confined to specified months when atmospheric conditions assist in obtaining the requisite temperature of the gases with ease.

Mr. Bagley says his view of the prospective position of benzol is summed up in his anticipation that its ratio of contribution to the total revenue from bye-products will equal, and then surpass, that from sulphate. This prognostication takes into due account its position as a motor fuel and the extension of the aniline industry in the country.

Conclusions.

To turn to the conclusions he has endeavoured to derive from a study of the commercial positions of the products forming the subject of the article. The prospective position of sulphate is more doubtful than hitherto; while there is every reason to anticipate an increase in the demand for, and value of, benzol, and to find it finally occupying the premier position in net revenues. Therefore, it is submitted that renewed and novel effort should be made to stimulate the home consumption of sulphate, even at the expense of nitrate; and that, assuming the aniline industry is to emerge on a more successful basis, supplies of nitric acid therefor, and for other industries, should—if expedient and economical—be drawn from sources oxidizing ammonia to nitric. Secondly, though perhaps paradoxically, the future design of ovens should permit of some acceleration of the output of coke, thus giving a degree of flexibility guided by the governing factors. Thirdly, effort should be directed to increased yields of benzol and the production of pure products therefrom.

Lastly, the development of benzol recovery and refining, in the author's judgment, forms the best means of holding and enhancing the net revenue from the bye-products of coke-works. Research justifies the hope that the yield may be increased in one or two ways; and the new era which it is hoped is to eventuate will provide largely increased outlets for the series of products destined to play a still more important part in industry and the increase in the national wealth.

A DESSAU GAS PLANT FOR ROCHESTER, U.S.A.

The Rochester (New York) Railway and Light Company are now having erected by the United Gas Improvement Company a Dessau plant, which is said by "Gas Record" (Chicago) to be the largest of its type in America—costing $600,000.

Approximately 400 tons of coal a day, or 150,000 tons a year, will be carried by a 30-inch belt conveyor from cars on the Rome, Watertown, and Ontario railroad siding opposite the plant to a concrete crusher house—a distance of 200 feet—to be reduced to the proper state for the generators. A 24-inch belt conveyor will take the crushed coal to the generator house, about 175 feet away, and dump it into the bins above the retorts. There will be 189 retorts, each having a capacity of 2100 lbs. when filled to within 4 feet of the top. They will be 22 feet long, the upper end 10 by 22 inches, and the lower end 18 by 30 inches. The 400 tons of coal consumed daily will make 4,200,000 cubic feet of gas. After carbonization, the coke will be dropped into bins, from which it will be taken by belt conveyors to a concrete coke-crusher house, and broken to suitable sizes. Another belt will haul the coke from this point to the screening bins, where it will be screened, assorted, and bagged for sale. The plant will have six coke-storage houses of concrete, with a hollow tile superstructure; the total capacity being 1000 tons. It is said that 2 million gallons of coal tar will be sold annually, and there also will be 700,000 lbs. of ammonia, besides other chemicals.

In building the plant, serious consideration is to be given to the

smoke and soot nuisance. A system of ventilators will carry objectionable waste vapours and dust through a stack 300 feet high. The smoke and dust will be washed out, and the neighbourhood will suffer no ill-effects. The system of smoke and dust removal alone will cost the Company about $40,000. The Company plans to clean its gas with an ionizer. The plant will have two chimneys, 170 feet high, and huge steel towers to support the conveyors. A large electric crane will be employed in dumping and gathering up coal and coke in the reserve yards. The old and the new plants will be connected by a foot-bridge across the river, 600 feet long and 12 feet wide, which will be supported by piers in the river and carry pipes enough to transfer the product of the new plant to the old for distribution. The main building, containing the retorts and other apparatus, will have a depth of 272 feet, a width of 53 feet, and a height of 80 feet. The plant will be of steel-frame concrete construction throughout.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Quarterly Meeting in Manchester.

The One Hundred and Seventy-Fifth Quarterly Meeting of the Manchester District Institution of Gas Engineers was held at the Grand Hotel, Manchester, on Saturday, May 27—Mr. EDWARD A. HARMAN, M.Inst.C.E., of Huddersfield, in the chair.

There was a large attendance—the promise of hearing Mr. John West, M.Inst.C.E., M.Inst.Mech.E., discuss the expansion, contraction, and refractory qualities of silica and fire-clay materials having evidently aroused much interest. A special invitation to attend the meeting and take part in the discussion of Mr. West's paper had been sent to the members of the Refractory Materials Committee of the Institution of Gas Engineers, and to manufacturers of silica and fire-clay materials.

The HON. SECRETARY (Mr. G. S. Frith, of Runcorn) reported the receipt of letters apologizing for absence—among others from Mr. John Young, of Hull, the President of the Institution of Gas Engineers, Professor J. W. Cobb, of Leeds, Dr. H. G. Colman, Dr. Mellor, Dr. Lessing, Mr. W. Doig Gibb, Mr. Alexander Wilson, of Glasgow, Mr. A. E. Broadberry, of Tottenham, Mr. Thomas Waddom, of Newcastle-on-Tyne, Mr. C. H. Webb, of Stourbridge, and Mr. S. Y. Shoubridge, of Sydenham. Acceptances of the invitation had, he said, been received from Dr. J. A. Harker, of the National Physical Laboratory, Mr. W. H. Hill, of Messrs. Mobberley and Perry, Dr. J. C. Meeley, of Messrs. E. J. & J. Pearson, and Mr. W. A. Drake, of Messrs. Drakes Limited.

THE LATE SIR CORBET WOODALL.

The PRESIDENT, in moving that a vote of condolence with the family of the late Sir Corbet Woodall, in the great loss they had sustained, be passed, said that words on such an occasion would be out of place; the occasion was just one, indeed, in which it might be said that silence was golden. Sir Corbet Woodall was well known to them all, and to the majority of them intimately. The gas profession had comparatively recently been called upon to sustain very heavy losses by the death of some of its greatest members—George Livesey, Thomas Newbigging, Joseph Hepworth, William Ford, Thomas Bower, Edward Allen, and last of all Corbet Woodall—a name well known all over the world.

The resolution was passed in silence.

MR. WEST'S PAPER.

Mr. FRITH, when reading the letters of apology for absence, remarked that he feared Mr. West would blush if he told them all that was in the letters—notably those by Mr. Charles Carpenter and Dr. Mellor.

The PRESIDENT said Mr. West needed no introduction—certainly not to members of the Manchester District Institution of Gas Engineers, by whom he had been known and respected for so many years. No one had been more active than Mr. West in the abolition of the exhausting labour of gas-works—first, by his famous stoking machinery, elevators, &c., and lately by the Glover-West system of continuous vertical retorts. He (Mr. Harman) considered it an honour to preside at any meeting at which such a paper was to be read as that which Mr. West was about to submit to the meeting. Mr. West had given up his leisure on a fine Saturday afternoon to come and instruct them on one of the most important subjects pertaining to the gas industry. The subject had come before them more recently than formerly, but it had lost none of its importance.

Mr. WEST then read his paper, which appeared last week, pp. 442-7; and it was followed by a long discussion, as reported to-day.

At the close of the discussion,

Mr. W. WHATMOUGH (Heywood) moved a vote of thanks to Mr. West for his "excellent paper."

Mr. S. MEUNIER (Stockport), in seconding the motion, said they had had very much valuable information from time to time from their old and esteemed friend Mr. West; but he did not think Mr. West had ever touched a subject which was of more importance than the one he had been dealing with that afternoon; and he (the speaker) was sure Mr. West himself must be satisfied with the result of his reading of his paper, for it had elicited remarks and information from various quarters which would have a stimulating effect on the consideration of the question. As for the Refractory Materials Committee, he believed they were in an embryo state; they were fishing. But he thought when they read some of the comments made respecting them, they would find something to their advantage.

The PRESIDENT, in putting the resolution, which was passed with acclamation, spoke of the rich treat which Mr. West had given them.

Mr. WEST, in acknowledging the compliment, thanked the members very much for their kind expressions of appreciation of his efforts. He hoped that what he had done would be of benefit to them both individually and collectively.

The members afterwards had tea together.

DISCUSSION ON MR. WEST'S PAPER.

ON SILICA AND FIRE-CLAY MATERIALS.

[*Ante*, pp. 442-7].

[It was explained in a paragraph in last week's issue of the "JOURNAL," when publishing the valuable paper on "Silica and Fire-Clay Materials" which Mr. John West read the preceding Saturday before the Manchester District Institution of Gas Engineers, that there had been a failure on the part of our reporter to send on a transcript of his notes of the remarks to which it gave rise. This omission has not since been rectified; but through the courtesy of the "Gas World," and of the various speakers, it is now possible for us to print a report of the discussion which followed the reading of the paper.]

The PRESIDENT (Mr. A. E. Harman, M.Inst.C.E., of Huddersfield), in calling upon Mr. West to read his paper, said it would be impertinence on his part to attempt to introduce Mr. West to any audience of engineers, and especially to a Manchester one. For so many years now Mr. West had been highly respected and esteemed by all of them. He could claim an acquaintanceship with Mr. West of about forty years; but many of those present had exceeded this. The work Mr. West had accomplished in reducing the exhausting labour of gas-works' operations had been enormous—first by means of his celebrated stoking machinery, conveyors, elevators, and other appliances, and latterly by the development and extensive adoption of the famous Glover-West system of continuous carbonization in vertical retorts. He (Mr. Harman) considered it an honour to preside at the meeting, which by reason of the eminence and the authority of the author of the paper to be read, as well as by a record attendance of members, manufacturers, and visitors, would he was sure become a historic one. The thoroughness and care which Mr. West had devoted to everything he had ever undertaken were abundantly demonstrated by the splendid diagrams and the large number of bricks, blocks, and other material in evidence in the hall. The work involved in the preparation of the paper must have been immense, and he was sure all would be delighted to be instructed in one of the most important subjects appertaining to gas-works operations, as well as to every other kind of work where furnaces were a necessity.

Mr. WEST then read his paper; and the following remarks were made upon it.

Mr. J. P. LEATHER (Burnley) said the subject of refractory materials was an important one, and Mr. West should have their sincere thanks for his communication, based on his large experience and the experiments for which he had greater opportunity than most men. Apart from the more exact tests, the method of testing by means of tongs at a high temperature was interesting and instructive. Along with Mr. West he (Mr. Leather) had felt the extreme importance of change of size. This was especially so with vertical retorts. In regard to this, Mr. West had hit the nail on the head when he emphasized the necessity of bricks being exposed to as high (or higher) temperature in the kiln as they were called upon to stand in use. If this was not done, an effect took place in the setting which ought to have been accomplished in the manufacture. It was also not always realized in testing material that time was important. The effect of heat might be either to alter the allotropic modification in which a substance existed, or to produce a chemical combination between different chemical substances in the material. In any case, a certain amount of time was occupied in the change. The change might be very slow if the temperature was not far removed from the critical temperature at which the change became possible, or it might be almost instantaneous at a sufficiently high temperature. A somewhat similar observation applied to testing under load. This might be illustrated by a stick of sealing-wax. If the stick was supported at the ends only, it would bend down slowly under the influence of its own weight at the ordinary temperature. It might take a day or two to bend in this way; but if one tried to bend it by force quickly, it at once snapped as though quite brittle. The question of the chemical and physical changes which take place in a brick under the influence of heat, was extremely complicated. Our knowledge of the chemistry of the silicates was indeed limited. There was a considerable amount of technical experimental knowledge which had done good service in the

past in producing the excellent material Mr. West said was attainable even in early days. But it was necessary to advance further; and, for this, systematic scientifically conducted research was required, in order that good results might be obtained with certainty. The Refractory Materials Committee were now entering on such research, and important results might be looked for in the next few years.

Dr. J. A. Harker (National Physical Laboratory), speaking as a member of the Refractory Materials Committee, said he had been a good deal impressed with the very important subject-matter communicated in Mr. West's paper, particularly in regard to one or two things. As Mr. Leather had pointed out, the substance of the fire-brick was a very curious material. Near its melting-point, it had properties very like those of sealing-wax. A stick of sealing-wax, supported at its ends, and only lightly loaded, was viscous, and yielded slowly, like any other viscous material; but the same rod, at the same temperature, struck a sharp blow, broke off short, like glass. Pure silica in the form of tubes or rods, such as were now purchasable, either in the clear or opaque form, showed very similar behaviour. A long rod of silica, supported at its ends, would slowly sag at a temperature in the region of 1300° C. It could, therefore, not be said to have any definite melting-point. Knowing these facts, when a prominent gas engineer some years ago sent to the National Physical Laboratory a sample of refractory material for study, they at once asked him whether he wanted the melting-point, or what might be called the yielding-point under load. The two things were fundamentally different. On testing the material, it was found that its actual yielding-point, under small load, was in the region of 150° to 200° lower than it had been said to stand in an unloaded test. This agreed with the experience of the engineer, who had been using the material on a large scale, and found that it began to misbehave at the temperature stated (the region of 1450° C., or thereabouts), although unloaded it was said to pass the Refractory Materials Committee's specification. This incident led to some further investigation; and at last he (Dr. Harker) was asked to join the Refractory Materials Committee. The Committee and Dr. Mellor were, of course, quite aware that these facts were not new; but a great deal of attention had been paid to them during the past few years. Dr. Mellor was now equipping his laboratory with new plant, in which tests of whole fire-bricks and large samples of gas-retort material could be made under load, under conditions similar to those in actual use. Speaking as a member of the Committee, he (Dr. Harker) believed he was representing their attitude in stating that they themselves regarded the present specification as merely provisional, and that they would welcome criticism and suggestions from anyone who had experience. The paper was full of interesting detail; and he would like to suggest that the verbal detail which Mr. West added in explanation of Table I. ought to be incorporated in the final paper. Dr. Harker then proceeded to refer to the difficulty in making tests of refractories, and the expense and wear and tear involved in such work. He said he believed that it was rather a matter for a central organization, with funds and resources at their disposal, than for the private consultant, whose fees would necessarily have to be high to recoup him. In conclusion, he was glad to hear Mr. West had found that British material had proved its superiority, and that he did not take the pessimistic view of some people as to the inevitable superiority of everything foreign. The paper showed how much a single British firm could do in the way of real investigation and systematic study of their products.

Mr. J. G. Newbigging (Manchester) expressed his thanks to Mr. West for so readily responding to the invitation given to him to read a paper before the Institution. He ventured to say that no engineer had done more for scientific carbonizing than Mr. West. A man of less forceful and initiative character could not have brought mechanical stoking to its present high state of perfection as Mr. West had done; and he (Mr. Newbigging) believed his continuous system of carbonizing in vertical retorts would be equally successful. Mr. West had thanked the Refractory Materials Committee for what they had done; but he did it, it might be said, for "benefits to come." Although Mr. Bywater read his paper as long ago as 1908, they had so far had but little result from the deliberations of the Committee. Whether this was an accident or not he could not say; but a certain firm delivering fire-clay material to Manchester a year or two after the reading of the paper presumably tried to conform with the specification of the Committee, with the result that the goods they supplied were of very poor quality indeed, and he was glad when they got back to their own standard of manufacture which had served them so well. He hoped the Committee's future deliberations and experiments would be of some benefit to the gas industry; so far they had not been. He made these comments in response to Dr. Harker's invitation for criticism. Experiments to be of service must be on a practical scale, as it was all a question of "*£ s. d.*" to gas engineers. Mr. West spoke of Manchester as having at one time almost invariably taken the lowest tender for fire-clay materials, irrespective of quality. This was practically the system when he (Mr. Newbigging) became Chief Engineer to the Manchester Gas Department. He soon told his Committee that this must be altered; and they began experiments with high-class materials. Having got very good results, they continued to buy such materials, irrespective of price. Very high heats were maintained in the settings in Manchester, as would be judged from the fact that in a retort 20 feet long and 24 inches by 16 inches in section, 36 cwt. of coal had been carbonized per twenty-four hours for weeks together, with a make of gas per mouthpiece of 11,260 cubic feet. The cost of maintenance and renewals of retort-settings twenty years ago in Manchester was somewhere in the neighbourhood of 8d. per ton of coal carbonized; but it was now done at a fraction over 4d. If the Refractory Materials Committee could enable him (Mr. Newbigging) to bring his costs down to 2d. or 3d. per ton of coal carbonized, he would be much indebted to them; for, after all, this was the crux of the question. Mr. West spoke of Sheffield, and the segmental retorts used there. He (the speaker) should like to know what was the cost of these retorts, and their maintenance per ton of coal carbonized, as compared with moulded retorts. Unless they could have definite figures, it was no use saying segmental horizontal retorts were better than moulded ones. So far his experiments showed otherwise. As Mr. West had remarked, economy in works' cost was an important thing, and, of course, this was what all gas engineers were aiming at. Mr. Leather had spoken of the proper burning of the material to the temperatures it would be subjected to when it was put into practical use. This was quite necessary, and perhaps in this direction the Refractory Materials Committee could render them some help. A judicious mixture of the constituents, and the necessity of the clay being well seasoned or weathered before being put into use, was of the greatest importance. He believed that many failures of retorts were due to neglect of these important matters, together with bad workmanship in the building of the settings.

Manchester Corporation Gas Department.

Cost of Retorts for the Twenty Years ending March 31, 1915.

Year.	Cost.	Coal Carbonized.	Cost per Ton Carbonized.
1896	£13,499	375,514 tons	8·63d.
1897	13,580	406,853 ,,	8·01
1898	12,975	383,491 ,,	8·12
1899	10,848	391,083 ,,	6·66
1900	13,126	401,971 ,,	7·84
Five years	£64,028	1,958,912 tons	7·84d.
1901	£15,551	396,165 tons	9·42d.
1902	14,079	382,933 ,,	8·82
1903	10,716	367,861 ,,	6·99
1904	10,740	353,026 ,,	7·30
1905	8,169	355,310 ,,	5·52
Five years	£59,255	1,855,295 tons	7·66d.
1906	£10,497	375,322 tons	6·71d.
1907	6,116	396,131 ,,	3·71
1908	8,714	421,365 ,,	4·96
1909	9,031	411,529 ,,	5·27
1910	7,886	408,322 ,,	4·64
Five years	£42,244	2,012,669 tons	5·04d.
1911	£7,501	418,144 tons	4·31d.
1912	6,513	406,587 ,,	3·84
1913	5,974	402,287 ,,	3·56
1914	7,667	442,983 ,,	4·15
1915	5,610	424,294 ,,	3·17
Five years	£33,265	2,094,295 tons	3·81d.
Total	£198,792	7,921,171 tons	6·02d.

Note: The above figures represent the actual cost of the retort-settings within the arch above the stage-floor level—including maintenance and renewals. They also include the maintenance of the producers. The proportionate costs of material and labour are about 70 per cent. and 30 per cent. respectively.

Mr. Samuel Glover (St. Helens) considered that the Manchester District Institution were to be congratulated upon having secured the presentation of Mr. West's paper on such an important subject. It gave the present-day conclusions of an up-to-date enterprising manufacturer, whose deliberations were always guided by the experience the author had gained during the many years he was a practising gas engineer and a buyer of refractory materials. The work of the Refractory Materials Committee of the Institution of Gas Engineers had been several times referred to during the discussion; and he was very pleased that the author was hopeful that the Committee were doing good work. Others, however, seemed to doubt this. All he (Mr. Glover) would ask the members to do was to give the Committee a chance. They had heard Dr. Harker's promise that the new points raised by Mr. West's paper should be brought under the notice of the Committee; and there was also Mr. Leather's contribution to the discussion of the subject that afternoon. Mr. Leather was the Honorary Secretary of the Committee. He (the speaker) had recently been appointed from the Institution a member of the Committee; and he was convinced that in having secured the help of Dr. Mellor and the governing body of the Potteries Laboratory, the Institution had already done a little in the way of securing the co-operation of science and practice which was so very desirable in the true interests of the gas industry. Already he had observed sufficient of the work and spirit of the Committee to enable him to repeat and confirm Dr. Harker's promise. The Committee was possessed of that quality of dignity, and was bold enough to change its mind and its methods if a better way of doing its work was developed than those which had been pursued while it had been engaged in its preliminary work. A matter of great interest and importance

was that of investigating into the quality and behaviour of refractory materials; and he was very pleased to notice that great attention was being given to the preparation of silica goods. He had tried silica goods during the last thirty years from several districts—including South Wales, Surrey, Yorkshire, and Derbyshire, with varying results; and he had known for a number of years that coke-oven experts had found material which particularly suited their work in coke-oven construction generally, and especially for linings. He had, however, been assured that this material did not differ so much chemically from unsuitable material as it did in the measure of care with which it was prepared. Now the question arose in one's mind as to what had been the reason at the bottom of some of the failures in the past of makers of British fire-clay goods; and the conclusion he had arrived at was that some manufacturers had been persuaded in their own minds that they happened to be possessed of the most wonderful quarry of clay that could be met with either in this world or the next, and had gone on quarrying it day by day under this delusion, and with the help of only ignorant workmen to whom it did not matter if the top had fallen in or got washed in. The stuff had been sent up to be ground, moulded, burnt in some measure, and sent out as finished goods, without sufficient care being exercised as to whether or not its quality was suitable for its ultimate purpose. Now these methods were being mended by firms upon whom reliance might be placed in future; and he sincerely hoped that proper standards of temperature to which the stuff was to be submitted in the kiln would be established. The temperature in the kiln ought to approximate very nearly, if not equal to, the temperature to which the material would be submitted when at work in the structure, and when working the process for which it was intended. Then it would be found, if the temperature was kept to the proper point for a sufficiently long time to allow it to soak in, that the conditions which obtained in a loaded kiln would test the stuff for distortion as well as melting point. The author of the paper was, he considered, quite right when he asserted that price should not be the chief guiding condition in deciding upon the value of fire-clay goods. It was certainly one point, but only one. It ought to be price and quality; and if quality could be secured, managers would be able to prove to their boards of directors and committees that structures built of good materials were able to earn a proper return. He was firmly convinced that British manufacturers would not be left behind by anyone in the future, and that if buyers and manufacturers worked together in the spirit which was being fostered in these later days, great benefits to both would be secured.

Mr. Albert Cliff (as a member of the Refractory Materials Committee) wrote that the tenor of Mr. West's paper was, from an English point of view, satisfactory, and the more valuable because he could look over the ground with the rare sweep of one who was a professional engineer as well as a professional silica brick manufacturer. Section X. of the Society of British Gas Industries was, he contended, thoroughly representative of all the leading fire-clay and silica manufacturers in Great Britain, and they welcomed the contributions of engineers to the investigations of these often abstruse and always complex matters—their experience being often highly instructive. It was a relief to find that Mr. West cast no imputations upon makers, but came to the case like a physician who puts his finger on the seat of mischief. The faults he indicated were largely the product of a cheap system of supply, by which users of refractory materials had bought retorts and bricks over decades of time, when 3d. per foot-run of retorts or 2s. 6d. per 1000 refractory bricks designed to stand the hottest fire zone of any conceivable pit were the deciding factors in the allocation of orders. Makers were not discouraged by the new standards; the reverse effect was already evident. The more exacting and scientific the demands (put forward in a reasonable spirit) the better; and the more was the fire-brick and silica industry exhilarated by imposing on it tasks which needed greater skill, more intelligence, and better men. Some parts of the paper called for no special comment from the manufacturing side—as, for instance, when Mr. West served up the results of recent investigations and tests. The designs, too, of the original and improved "Ricon" silica segmental retorts were, he felt sure, much behind the designs of some English engineers, if an elastic, well-knit-up, and durable setting was the chief aim. When Mr. West instituted a comparison between German bricks and silica bricks in the arches of the Copenhagen Gas-Works—although Englishmen had all long ceased from their former proneness to look upon things German, whether scientific or clumsy, as marvels of refinement—one could not, in all fairness, castigate the German material at Copenhagen for apparent failure. Silica bricks were invariably, if not always, the best for arches. They had a tightening modulus of expansion, and if anything an upward thrust; whereas the German material, being fire-clay in grade and quality, would be expected to contract, slacken, and probably come down. Alike the most vital and the most recalcitrant problem tackled in the paper was that of expansion and contraction, which Mr. West described as serious and important. Here, again, Mr. West gave the results of a valuable and rare experience. He said that after many experiments he had succeeded in making an excellent highly refractory brick, which showed no signs of expansion or contraction; and this was subsequently confirmed by Dr. J. W. Mellor at cone 12, 2462° Fahr. How was it done? This omission was the almost fatal weakness of the paper; and the explanation was vital to the maximum power and usefulness of Mr. West's paper. Could it be taken that the best silica material was that which most perfectly got rid of its modulus of expansion at the first heating, and which showed the least change in volume when subsequently heated over and over again? If the first heating was really adequate, then there was little to fear later on. This no doubt was roughly true as applied to both contraction and expansion of bricks. The question, therefore, was not so simple from a manufacturing point of view as from that of the average user. The call for the more perfect elimination of contraction and expansion as characteristics of all fire-clay and silica material called in many cases for radical changes in types of kilns now in vogue at many works. Higher soaking heats and more uniform fire control were required. Every fire hole in an ordinary down-draught kiln—a type widely regarded both at home and abroad as an approved method of burning—had the mouth of a shark; and with the increasing cost of fuel and the necessity of giving materials greater punishment along with the consequent increase in wear and tear, suggested a point at which cost alone might become a deterrent, except in the case of materials required for special and particular work. There was, of course, much more to be said on these difficult matters; but their aim should be to get bricks (when so wanted) stationary in use—reserving the use of buck-stays and props as mere precautions against error in construction or other fault. It might be well to remember that an Englishman invented the silica brick, proved its infusibility, and established its value and reputation in furnace work. The Americans and Germans alike copied both its manufacture and its use; and as in the time of West and Young, so especially to-day, there was still plenty of work in this field to be done by keen brains and eager hands. Every influential man ought, like Mr. West, to insist that this was a class of service the country badly needed just now from all who could give it. They might all fittingly take to heart Mr. West's words of encouragement to exert themselves to bring in a still more efficient industrial order.

Mr. Samuel Tagg (Preston) thought that not only the Manchester Institution but the gas industry generally was much indebted to Mr. West for his valuable paper. The question raised by Mr. West, as to the behaviour of refractory material subjected to pressure while at a higher temperature, was a very interesting and important one; and he (the speaker) hoped the Refractory Materials Committee would continue this line of research, so as to obtain information about the most suitable material for machine operated horizontal retorts, which in these days of heavy charges were subjected to very considerable frictional wear. With regard to segmental retorts, his experience at Cheltenham, where these retorts were exclusively used, decided him to follow the Sheffield practice, and instal segmental retorts of silica material. He was unable to give the comparative costs of segmental and moulded retorts; and the former had not been in use sufficiently long to determine their life. They had, however, been working for over 600 days, and should be good for at least as long again; while the average life of moulded retorts worked under similar conditions was 1060 days. Segmental retorts of moderate section were, he considered, more suitable for machine charging, as they retained their shape, and he thought that their higher first cost would be fully compensated by their longer life and better facilities for repairs.

Mr. John Bond (Southport) considered the Institution particularly fortunate in securing from Mr. West so valuable a contribution on silica and fire-clay materials, which he felt confident would be highly appreciated by the members. Mr. Leather had referred to the all-important time-factor in connection with the chemical and physical changes of refractory material. He (Mr. Bond) was anxious to adopt a time-factor in discussing the paper, as he was wishful to hear what other speakers had to say upon the subject. With respect to the research conducted by the Refractory Materials Committee under the direction of the Institution of Gas Engineers, his experiences had been contrary to those of Mr. Newbigging; and he was satisfied that the majority of firms tendering for the various classes of fire-clay material had improved their mixtures. Not only had this been the case, but the existence of such a Research Committee had tended to stimulate the minds of various gas engineers and manufacturers of fire-clay material throughout the country; and they were now taking a more active part in tests both of a physical and a chemical nature in connection with this material. The subject of research was not by any means an easy one; and the chemical analysis did not reveal the many physical changes which from time to time took place from the start to the finish. Some time ago he had occasion to examine two lots of silica material from different sources. Each sample contained approximately 85 per cent. of silica; but he found that one sample expanded considerably more than the other, which showed how very important it was to study the physical side of this vast subject. Indeed, he was led to believe that the physical problems had a much greater bearing on fire-clay materials than the chemical. He was pleased to note that Mr. West emphasized the importance of testing refractory materials for expansion and contraction in a practical way—as shown by figs. 1 and 2 in the paper [*ante*, pp. 443-4]. On many occasions he (the speaker) had conducted temperature measurements of retort-settings, and had had an opportunity of noting that, with some materials, considerable expansion and contraction was the cause of the depreciation of the life of retort-settings. Therefore he was of opinion that it was of the utmost importance that this part of the research should have every consideration. There were other important matters—such as the conductivity of fire-clay material, density, temperature

under load, and burning—that required some further investigation. Full attention could not be given to these problems during the war crisis; and, unfortunately, it had been necessary for him to abandon all work in the Gas Department refractory materials laboratory at Southport until the conclusion of hostilities. Professor Cobb had done a considerable amount of good work on refractory materials at the University of Leeds, and would have been present to join in the discussion of Mr. West's paper; but unfortunately another pressing engagement prevented his attendance. He (Mr. Bond), in conclusion, said he felt convinced that the work which had been, and would be, conducted not only by the Refractory Materials Committee but by manufacturing firms and scientific men would have a great bearing on the future prosperity of the gas industry.

Mr. J. C. Deeley (Messrs. E. J. & J. Pearson, Limited, of Stourbridge) expressed his disappointment that Mr. West had not dealt with other fire-clay materials so completely as he had done with silica; but he could heartily congratulate Mr. West on his very valuable contribtion to the science of refractories—particularly as his tests were all of a practical nature. He (the speaker) would specially impress upon the engineers present, the importance of one sentence in the paper, reading as follows:

> "It therefore becomes necessary that watch should be very carefully and continuously kept over the practical working of retort-settings when working at high temperatures, or there would be risk of collapse—a disaster of which probably some of you have had a little experience.'

He thought too much was heard about the failure of fire-clay material, and too little about the gas engineer who was aiming at the impossible. He instanced an engineer (with whom some present were acquainted) who was trying to get 17,000 cubic feet of gas per ton of coal carbonized; and in his efforts he had reduced his settings to a very fine glass-making furnace, placing all the blame upon the fire-clay materials (as usual). He considered the chief deduction to be made from Mr. West's paper was the great importance of ascertaining the exact softening point of any silica or fire-clay material. This in his (Mr. Deeley's) opinion was more important even than the so-called refractory point. He gave practical instances from his own personal experience in which the difference between the two was proved to be very considerable. He warned those present not to trust too much to the chemical analysis of refractory materials, or even to laboratory tests, as the problem was essentially a practical and at the same time a most difficult one. However, he was glad to assure members that his firm, as well as others in the Stourbridge district, had given earnest attention to the subject under discussion.

Mr. Robert Watson (Doncaster) said that one of the previous speakers had incidentally referred to the fact that the makers of fire goods were not in the same happy position as Mr. West, who was able, after making a retort, to watch its condition during the whole course of its life. He (Mr. Watson) suggested that retort-makers could easily get the like opportunity if they chose to send representatives from time to time to the gas-works where their retorts were in use. The great majority of gas engineers would be glad to see these representatives; in fact, would welcome their visits, in view of the purpose for which they came.

Mr. J. C. Belton (Chester) said they were greatly indebted to Mr. West for the able manner in which he had dealt with the subject. The paper would be a very valuable addition to the "Transactions" of the Institution. Mr. Newbigging had criticized the proceedings of the Committee for research in connection with refractory materials; but he (Mr. Belton) thought they had done some most useful work, and if they needed direction as to the line upon which their investigations should be pursued, it was suggested in the paper. It would be most useful to discover whether, and to what extent, different effects were produced upon the chemical or physical properties of fire-clay material by gradual heating-up to a high temperature, and by the intermittent heating and frequent variations of temperature in practical use. The specification of the Refractory Materials Committee said "when heated to;" but this was too indefinite and needed modification. Mr. West had not stated in which category—"silica" or "silicious"—he placed the Derbyshire material upon which he had based his paper; and it would be interesting to know this.

Dr. Rudolf Lessing wrote: "I am particularly sorry not to have the pleasure of hearing Mr. West's paper on silica and fire-clay materials, as I feel certain that his wide experience on the subject will be of great value. It may be of interest to your members to know that the use of silica material for retort-setting has made great progress in the United States. I had an opportunity recently of comparing the present state of this question with that of about four years since, and found the American gas engineers are supplied with material for settings which could not have been constructed with the refractories in use a few years ago. It is, therefore, of vital importance that the manufacture of silica bricks and blocks should be taken up more vigorously than has been the case hitherto."

The President, before calling for the author's reply, said there had been a most gratifying discussion which could probably be prolonged to any extent, but the time available had gone. Might he submit a couple of questions to Mr. West before asking him to reply to those already raised? As they all knew, Mr. West was a large purchaser of bricks of all kinds for use all over the world and under every variety of conditions in gas-works, steel-works, china-works, &c.; and it would be most interesting and suggestive to know from him what kind of a specification he prepared when inviting tenders for fire-brick materials from the manufacturers. His experience as a large manufacturer, and also as a large purchaser of gas-works material, would be valuable. Might he call that Question No. 1. Further, he noted that Mr. West pointed out in his paper that most of the silica material he used contained 96 per cent. of pure silica. In anticipation of the reading of the paper, he (the President) had been looking through Mr. Bywater's paper read in 1908 before the Institution of Gas Engineers, and he found that Mr. Bywater said that the deposits of silica beds in Derbyshire contained only 81 per cent. of silica, and he gave an analysis of the deposit. He (the speaker) would like to ask Mr. West if the pits he was working were an exception to the general run of pits that were worked in the Derbyshire district. This was Question No. 2. He added that he had been privileged to inspect Mr. West's silica brick works in Derbyshire, and could testify to the scientific and orderly manner in which all the operations were conducted. Each man and woman—for since the war women had been introduced to replace the large number of men who had gone to the front—was in his or her right place diligently working with machine-like precision and accuracy, and with a sublime indifference as to whether their operations were being inspected or not. Upon inquiry, he found that everyone engaged upon the works—from the manager downwards—had been trained at the works, and had not been engaged at any other brick works. They were all directly and indirectly pupils of Mr. West. The whole works were the best constructed and best managed brick works it had been his good fortune to inspect. By to-day's contribution, Mr. West had placed the gas industry, as a whole—because the paper would have a huge audience through the Technical Press—under an additional debt of gratitude.

Mr. West, in the course of his reply, said there was naturally a question both of physical and chemical constitution. It was very difficult to go into; and he thought it would take some of the most eminent doctors a long time to give a thorough exposition on the subject. Certainly, he was not going to tire the meeting by trying to do it. No doubt many changes took place. In some experiments he found that the materials first of all contracted and then began to expand; and as the temperature increased, the expansion took place at a rather faster rate, until they got as high a temperature as the kiln would give them. There was no doubt the Refractory Materials Committee were doing very good work, and they asked all gas engineers to assist them. There was a great deal which required finding and fishing-out. They wanted to know more as to what went on in their retort-settings under high temperatures and under load. As Mr. Tagg had said, there was perhaps something more than the load. The expansion was very severe at times; and in using silica bricks one should take care to make provision for expansion. It was necessary to know what the expansion was likely to be before they started. As for the Refractory Materials Committee, he hoped that what had been said that day would fire them. He had every confidence in Dr. Mellor; and he believed the other members of the Committee were just what he called getting a grip of the thing, and it behoved those engaged in the gas industry to help them all they could. He mentioned Sheffield because it had been said that segmental retorts there had a long life, and one would have thought they were tolerably economical. Mr. Newbigging apparently was not of this opinion. All he (Mr. West) could say on this point was that if they lasted longer they ought to be more economical. He agreed with Mr. Glover that they must give the Refractory Materials Committee a chance. He also agreed as to the necessity of subjecting the materials to a proper temperature when in the kiln. If the material was burned well in the kiln at first, there were not those contractions and expansions afterwards to the same extent as when the materials were improperly burned. As to the segmental retorts at Cardiff, mentioned by Mr. Tagg, they were doing very well. Touching the President's question, his firm were large buyers of material, but perhaps their specifications were not so trying as one might imagine. The first thing they did was to decide upon the district from which to get the materials; and this depended on where the work was to be put up. Then they looked out for the best makers. They did not invite everybody. The process, first of all, was to make a nice drawing, with all the various sections and parts to a large scale and very accurate. Then they asked the makers to provide what was wanted, and in doing so make all allowances for expansion and contraction of the material. The next thing insisted upon was that the material must be completely burned. Next they laid down the refractoriness of the brick, which ranged from 3000° upwards—never less than 3000°. They had never put anything up that would not stand 3000°; and he had not had much difficulty in getting very good material. The retort-makers had done their very best to meet his requirements in every way; and he was pleased with the manner in which the manufacturers had tried to meet his conditions. The first thing they had to do was to satisfy them as to quality. He never talked about price; he only talked about quality.

On the 1st inst., at St. Thomas's Church, St. Annes-on-Sea, Engineer-Lieutenant E. Bertram Williams, R.N.R., H.M.S. "Changuinola," son of Mr. and Mrs. John E. Williams, of St. Annes and Manchester, was married to Annie May, youngest daughter of Mr. and Mrs. I. W. Iredale, of Halifax.

YORKSHIRE JUNIOR GAS ASSOCIATION.

A Meeting of the Yorkshire Junior Gas Association was held at the Leeds Institute of Science on Saturday—the PRESIDENT (Mr. J. Demain) in the chair.

Mr. JOHN W. LEE, of Hasland, Chesterfield, read a paper on "Some Notes on Fuel Economy," illustrating it by diagrams and blue prints, which the members had an opportunity of examining.

SOME NOTES ON FUEL ECONOMY.

Under the strain imposed by war conditions, and my own particular circumstances, it would have been more in accordance with my wishes if I could, in an informal manner, have talked to you on the subject of my address. The preparation of MS. open to the Technical Press imposes a restriction which is not felt when, in the privacy of our meetings, we can chat of our own works experiences.

As the Secretary says in his notice of meeting, my subject is appropriate, though I fear that "Economy" and "Fuel Economy" may have a tiresome sound to you. The subject has been constantly before us. From a hundre points of view we have had it under consideration. Professor Bone, in his Royal Institution lectures, has laid down the broad principles of the utilization of coal. Aided by the members of the Fuel Economy Committee, he has brought before the country striking and thought-producing facts. We have heard, and in a measure rightly, of available gas—coke-oven, blast-furnace, &c.—not being utilized at all, or in an uneconomical manner. Large schemes of central power stations have been laid before us, and many have been the discussions we have listened to.

Admirable some of these schemes may be (and it is not my intention now to discuss their merits or demerits). It has been regrettable that, in the meetings called to discuss the problem, more opportunity has not been given to the audience to give information of their own peculiar conditions and difficulties, and gain assistance in dealing with them. In this direction will most good be done, and not by the delivery of speeches dealing with the problematic advantages and disadvantages of this system or that of utilizing a quantity of gas, whose volume is loosely spoken of in millions, but the meters for the measurement of which have not yet been ordered. I am conscious that there is much room for economy in the utilization of coal and its bye-products in this direction, but am also certain that many Acts of Parliament will need serious examination and amendment, and little less than a revolution will be necessary before the Empire's weal obtains paramount place.

Further, the clash of opinion among the experts as to the adoption of gas-engines or steam-turbines for utilizing the available power, and whether it shall be distributed as gas in high or low pressure mains, or as electricity of high tension, and, what is more important still, the lack of data which would assist the ordinary engineer in coming to a decision, delays its utilization. Our own collective experiences of the delay in obtaining material for imperative repairs, when such material has been awarded a position by the Priority Department in the magic "Class A," suggest that not one such scheme—large or small—has much chance of being brought to a successful issue in such time that any advantages that might accrue would be available during the war.

I would suggest, however, to the powers that be that the energies of the Fuel Economy Committee should be turned in another channel, and immediate direction be given to all users of fuel for power purposes as to the most economical manner of working the plant at their disposal. This would yield an immediate saving, which it is difficult to put into terms of percentage without seeming to exaggerate. Certain I am that, if properly done, the saving effected on the works run on the best conditions would be surprising, and on others staggering. Because of the certainty, I venture to add my quota to the much discussed subject of

FUEL ECONOMY.

It is fitting that it should be so dealt with in an Association whose members are, in great part, because of the war service which their industry is fortunate enough to be able to render, exempt from service in the field. My purpose is to suggest a further direction in which you can serve

I would have you enrol as "Fuel Savers;" and in view of my association with the coal industry, the purity of my motive will be admitted. The members, especially the younger ones, of such a company will have no light task. Within a short period of commencing to put the first principles into practice, they will come into conflict with the practical man "who saw boilers before they were born," and will privately express a hope that they will not long obstruct his view.

From my years of active association with your industry, and my present barely less active interest in it, I am of opinion that more real effort has been exerted in fuel economy by gas engineers and chemists than by any other company of fuel users. I bear in my body the marks of long years spent in every conceivable position examining at every available point the gases and temperatures of retort-settings. I would impress upon you, what I might not have been willing to admit then, how important such work is. I am not so sure, however, that the same attention has been given to economy at the boiler plant. Coke breeze, pickings from producer clinker, have seemed so plentiful and cheap that the necessity for similar work at this point has not been so apparent. There is no such thing as cheap fuel to-day; and even if there were nothing obtained from coal, the nation's great commercial asset should be cheap enough to waste.

Without a shadow of doubt there is waste in your boiler plant. Everybody is too busy thinking in terms of carbonization, purification, and toluol extraction to give a thought to what may be the least efficient portion of his plant. Its position—so unobtrusive, off the beaten track, forgotten except in times of low steam pressure—tends to its neglect. The fireman, often untrained and sometimes untrainable, is left in charge, and when his steam is low advances his one excuse—the fuel. For lack of expert attention, therefore, on every boiler fuel will be wasted. Make it your business to supply such attention. Key-up the efficiency of your boiler plant to the same pitch as every other part. Given a central power station selling energy, every consumer will demand the receipt in full of the quantity for which he pays. Make a similar demand of your power station. Great care is given to the accuracy of your weighing machines, in order that you may obtain full weight. Give the same care to see that you obtain a full return from your boilers. This will necessitate the careful examination of every part of your plant, and attention to a great many seemingly little things. In other words—the application in this department of the same methods as in every other.

Fuel waste is of two kinds—avoidable and unavoidable. The latter will amount to from 40 to 50 per cent., and is divided among such items as radiation, heat in chimney, gas necessary for draught purposes, heat in ashes, &c. In the former—which may reach as high a figure—are included losses due to radiation, ash, handling, incomplete combustion, air leakage, and excess. It will not be a great task to examine the insulation for soundness, as well as the ashes for coke and coal, and put these matters right. When this has been done, 20 to 25 per cent. of the avoidable direct losses will have been stopped; and of the remainder, up to 70 per cent. will be due to excess air. It is a truism to say that the most efficient furnace is the one which completely burns the fuel with the least excess of air. This point has had full recognition in the working of retort-settings. The application of the same principles and methods to the boiler plant, which have resulted in such high efficiency in the retort-house, will yield an equally good return.

The next examination must be that of the physical condition of the boiler, differentiating clearly between boiler efficiency and

FURNACE EFFICIENCY.

In order to burn the fuel completely, the amount of air required will vary with the percentage of ash; but an excess of about 40 per cent. will be necessary. All above this represents waste. The chimney will draw in air from every available point. Carefully examine the brickwork, &c., by means of a torch, and caulk every crack with fire-clay and waste or spun-yarn. Do the job well—it is worth doing. I have seen the CO_2 content of the chimney gas increase from 5 to 11 per cent. after such a caulking—a saving of 19 per cent. in fuel. When the soundness of the brickwork and fittings has been assured, it will be necessary to analyze the chimney gas. The Bunte burette or Orsat apparatus will do admirably. To gas men, I need not explain their manipulation. Suffice it to remind you of the necessity of taking samples in the correct position—in the full current of gas as it leaves the last heating surface. Also it may be necessary to take samples at earlier points, at temperatures at which sampling tubes of iron will give unreliable results. Silica glass tubes need careful handling; otherwise they are excellent. The following results of samples taken simultaneously will be of interest:

	CO_2.	O.	CO.
A. Iron tube. . . .	13·7 ..	0·6 ..	3·2
Silica ,, ...	18·5 ..	1·5 ..	*Nil*
B. Iron tube. . . .	13·4 ..	1·8 ..	1·4
Silica ,, ...	15·0 ..	5·2 ..	*Nil*
C. Iron tube. . . .	13·0 ..	*Nil* ..	4·0
Silica ,, ...	16·8 ..	2·4 ..	*Nil*

The composition of the chimney gas will be an index of your furnace efficiency, as the following table will indicate:

CO_2.	Air Excess.	Loss Fuel.	Avoidable Fuel Loss.
Per Cent.	Per Cent.	Per Cent.	Per Cent.
15	38	12	*Nil*
14	48	13	1·0
13	59	14	1·7
12	72	15	2·8
11	88	16	4·1
10	107	18	5·7
9	130	20	7·6
8	159	23	9 7
7	196	26	13·0
6	245	30	17·1
5	314	35	22·8
4	417	45	31·3
3	590	60	45·3

To show the purpose of this, I take a recent series of tests. A boiler chimney gas showed 5 per cent. CO_2, equal to 35 per cent. of actual fuel loss, or taking 15 per cent. CO_2 to represent the limit of practical working, 23 per cent. of avoidable fuel loss, and showing excess air 314 per cent. All the cracks in the brickwork and

fittings were found and soundly caulked, and the CO_2 increased to 9 per cent., showing 20 per cent. of actual fuel loss, or 8 per cent. of avoidable fuel loss, and 130 per cent. excess air. An examination of the fire revealed unequal thickness. When this had been remedied, the boiler began to blow, and the damper was closed. Further tests revealed that the CO_2 content in the chimney gas had gone up to 14 per cent., equal to 13 per cent. of actual fuel loss, 1 per cent. of avoidable fuel loss, and 48 per cent. excess air. Could such a saving be obtained on every boiler plant in the country and maintained, an enormous quantity of fuel would be saved, a large number of men could be available, and no central power house scheme would issue its prospectus.

To illustrate in another way with three actual twenty-four hour records, A, B, and C. They show an average CO_2 content in the flue gases of A, 14 per cent.; B, 10·5 per cent.; and C, 5 per cent. A Lancashire boiler, 30 feet by 7 ft. 6. in., consuming (say) 35 tons of fuel per week under "A" conditions, would require 36·6 tons under "B" and 46·8 tons under "C"—assuming the temperature of the gases to be about 250° C. in each case. Take thirty such boilers (our own conditions), and fuel at 10s. per ton, and the weekly fuel bill would be £525, £549, and £702 respectively. I venture to suggest that the great majority of boilers are working under the conditions represented by "C," or worse.

Locate leaks by means of CO_2 tests, and, having stopped them, by the same test (aided, if possible, by a pyrometer) determine for each boiler the conditions of draught and the physical conditions of the fuel, greater area, &c., which yield the highest percentage, and you are on the high road to furnace efficiency.

Boiler efficiency will not of necessity have been attained. This will call for the examination of boilers and boiler-tubes for scale, soot, &c., and the removal of them if present, as well as proper insulation and attention to a multitude of little things which will promptly reveal themselves to the keen observer.

Testing Apparatus.

The purpose of my paper is not yet fulfilled; nor will it be possible, having determined the best working conditions for one day, or over a period, to leave the plant. To obtain lasting results demands constant attention and supervision. Take the fireman into your confidence; and explain in simple language, as free as possible from scientific phraseology, the principles of fuel economy. He may not understand, but you will get him interested, and working with you instead of against you. Having keyed-up your plant, the installation of recording instruments, working in full view of the men, will be necessary in order to keep it so. A CO_2 recorder and draught gauge are essential. To some a recording pyrometer might be thought a laboratory luxury, not permissible in war time. Of its usefulness, however, there can be no doubt.

It is not my purpose to say which type of apparatus you should adopt; but I know no better CO_2 recorder than the Simmance-Abady. It is sound in construction, accessible in every part, requires the minimum supervision, is cheap in upkeep, reliable, and accurate. Whatever you introduce, explain its working and purpose to the firemen. At first they may look upon it with suspicion, but in a few days they come to regard it as a friend. Remember no CO_2 recorder will produce fuel economy. Its purpose is simply to record whether your instructions have been carried out, and the proper working conditions maintained in your absence.

If, in addition, you can add to the multitude of duties you have to perform daily tests of the boiler fuel for moisture, ash, and calorific value, you will have all the data you should need for economical working, and be able to explain variations in boiler fuel costs from week to week. Send in to your chief a daily report of the results you obtain. The manner in which this should be done your own circumstances must decide.

Testing Gas-Engine Exhausts.

At the risk of wearying you, I venture to suggest another point at which my experience shows it advisable to look for fuel wastes. The consumption on gas-engines can be much reduced by constant testing of the exhaust gases. I have not used my CO_2 recorders at this point. A simple form of CO_2 recorder would be useful. A few tests per day with a Bunte burette will (with war-time staffs) suffice. A sample of exhaust gas from a large engine blew my Haldane mine apparatus to pieces.

I am conscious that I have dealt with a very large subject in a scrappy and, perhaps, unsatisfactory way. I have had, perforce, to write it in haste in hours between sunset and sunrise; but I shall be more than repaid if I have made you realize how, without a farthing outlay on new plant, you can assist in a scheme of fuel economy which will bring an immediate return.

DISCUSSION.

The President said they were deeply indebted to Mr. Lee for the paper. The subject was particularly appropriate at the present time, and no man in the Association was better able than Mr. Lee to speak on any question relating to fuel. There were a number of points which might be touched upon; but the one which struck him most at the moment was that in regard to the fuel consumption of the boilers for steam-raising in the colliery. Mr. Lee had, in an aside from the paper proper, mentioned a certain figure of consumption which he did not wish to be published, but which he regarded as excessive. He (the President) knew of a local colliery in his own district whose commercial manager was very bitter on the subject of coal wastage.

Mr. Charles Roper (Bradford) said he entirely agreed with Mr. Lee in regard to the trouble caused by leaving in charge of boilers firemen who were untrained, and, in some cases, practically untrainable. It often happened that the firemen on the boilers were men who had in the past done their share of hard work as gas stokers, and had been put on the boilers as a slightly lighter job; but they considered themselves old-established and experienced firemen. They all knew well that if better fuel was to be found handy, and a close watch was not kept, the firemen would not take the commoner stuff which made for economy. He well remembered a case in which the men cried out that they must have best breeze; the common breeze which was given them, they said, could not be made to burn. However, a hundred tons of this common breeze had to be burnt; and it went all right when there was nothing else to burn. It simply indicated the fact that, if the men were left to themselves, they would not use economical fuel if the better kind was available, as it so often was on a gas-works. Another point had occurred to him, and this was about general waste on gas-works. There did not seem to be many works in that district which had gone in for washed pan ashes. A certain amount of coke could usually be obtained this way, and something could be saved, particularly on small works, where it should be worth while. In regard to tightening-up loose metal doors and caulking-up cracks, he might say there was a particular boiler he had in mind which would have his attention in this direction at the first opportunity; and he felt sure such attention would yield some improved results when he put a little packing in the metal door. There had been food for thought for everybody in the paper.

Mr. E. Halliday (Yeadon) said the point which struck him was that there was a great field for economy in the distribution of power efficiency. When he was a steam-engine student, the efficiency, he remembered, worked out at about 6 per cent. Had Mr. Lee ever tried gaseous firing?

Mr. Lee replied that in his own case they had a number of boilers under waste heat; and they raised the whole of the steam they required on the coke-ovens from their waste-heat ovens. They were also able to supply waste heat for colliery boilers. They did not use any gas for steam-raising purposes direct. They consumed roughly 700,000 or 800,000 cubic feet of gas per day for engines and lighting, and for fires and bath-heaters, &c. So that though his concern was a coke-oven firm attached to a colliery, they had still some claim to be gas engineers.

The Hon. Secretary (Mr. E. Garsed) remarked that the chief thing which occurred to him was the lesson they should learn from the paper. Mr. Lee had touched on fuel almost exclusively from the point of view of coal; but coal was not their only fuel. They had gas. There was on all sides a call for economy; and nobody could blame the gas industry for advising everybody to burn more gas. As long as he had known it, the one idea hitherto instilled into everybody had been to get the consumers' gas bills down. The paper by Mr. Lee had driven home to them all what room there was in various ways for real effort in the direction of economy. He (Mr. Garsed) appreciated the quiet way in which Mr. Lee had indirectly complimented the gas engineers on their attention to the retort-setting, and told them to look as well after the boilers. An idea was growing, he thought—and he certainly was inclined to agree with it—that the ordinary usage of coal in the open fire-grate was wicked waste. He would like to voice the sincere thanks of the meeting to Mr. Lee for his paper—particularly in view of the knowledge that Mr. Lee could have very well done without this labour at the present time. He had been far from well personally, and was an extremely busy man. The subject provided material for treatment from many points of view; and he hoped some members would follow up Mr. Lee's paper.

Mr. Settle (Bradford), seconding the vote of thanks, said he remembered at one time a certain gas-works where the point of stopping-up air-cracks arose. An economizer was in use. The electricity works were in the same yard as the gas-works. The installation which he was putting up at the time had to pass through the same chimney as was used by the electricity works; and he had thought the troubles which occurred must be due to a fault in the electricity boilers. But he followed the course suggested by Mr. Lee, by taking a torch round. He found the torch was not necessary. The first thing he discovered was that a man who had been inside to clean the economizers out had left the man-hole off. After that, he set to work on the air-cracks; and it took a labourer a week to plaster them all up.

Mr. Lee, responding, said, though it was a fact that the preparation of the paper, under all the circumstances, had been rather heavy on him, he had done the work gladly, because he was interested in the welfare of the Association. He was certain of the necessity of economy, and that the loss of fuel in this country was enormous; and if only they could get economy well established in their works, it would be unnecessary for the Board of Trade or anybody else to issue circulars suggesting that gas-works, of all people, should reduce their consumption.

The President then intimated that the Directors of the Garforth Gas Company wished to extend an invitation to the members to a little outing on a Saturday in the near future. They proposed a motor char-a-banc drive, starting from City Square, Leeds, about 2 to 2.30 p.m., and visiting Harrogate, Boston Spa, and Tadcaster, with tea at Boston Spa. Unless circumstances over which nobody had control intervened, the event would take place on the 17th inst. He hoped it might be possible to include a brief visit to the Garforth Gas-Works.

THE APPLICATION OF COAL GAS TO THE PURPOSES OF ILLUMINATION.

A Hundred Years' Old Document.

There was recently unearthed a copy of the "European Magazine," Vol. LXIX., dated May, 1816, containing No. 27 of "A Select Collection of Fugitive Pieces." This particular one was by William Thomas Brande, F.R.S.L., Emeritus Professor of Chemistry at the Royal Institution. It gave his observations on the application of coal gas to the purposes of illumination—a hundred years ago—and does not appear to have been reproduced elsewhere.

The Professor wrote: The employment of gases evolved during the destructive distillation of common pit-coal for the illumination of streets and houses is a subject of such intrinsic and increasing importance as to render some account of its progress and improvement a proper subject of discussion.

That coal evolves a permanently elastic and inflammable aëriform fluid seems first to have been experimentally ascertained by the Rev. Dr. Clayton; and a brief account of his discovery is published in the "Philosophical Transactions" for the year 1739. The following is an extract from his paper:

"I got some coal, and distilled it in a retort in an open fire. At first there came over only phlegm; afterwards a black oil; and then likewise a spirit arose, which I could no ways condense. But it forced my lute, or broke my glasses. Once when it had forced my lute, coming close thereto in order to try to repair it, I observed that the spirit which issued out, caught fire at the flame of the candle, and continued burning with violence as it issued out in a stream, which I blew out and lighted again alternately, for several times. I then had a mind to try if I could save any of this spirit, in order to do which I took a turbinated receiver, and putting a candle to the pipe of the receiver whilst the spirit arose, I observed that it catched flame, and continued burning at the end of the pipe, though you could not discern what fed the flame. I then blew it out, and lighted it again several times, after which I fixed a bladder, squeezed and void of air, to the pipe of the receiver. The oil and phlegm descended into the receiver; but the spirit still ascending blew up the bladder. I then filled a good many bladders therewith, and might have filled an inconceivable number more, for the spirit continued to rise for several hours, and filled the bladders almost as fast as a man could have blown them with his mouth; and yet the quantity of coals distilled was inconsiderable.

"I kept this spirit in the bladders a considerable time, and endeavoured several ways to condense it, but in vain. And when I had a mind to divert strangers or friends, I have frequently taken one of these bladders, and pricking a hole therein with a pin, and compressing gently the bladder near the flame of a candle till it at once took fire, it would then continue flaming till all the spirit was compressed out of the bladder, which was the more surprising, because no one could discern any difference in the appearance between these bladders, and those which are filled with common air.

"But then I found that this spirit must be kept in good thick bladders, as in those of an ox or the like; for if I filled calves' bladders therewith, it would lose its inflammability in twenty-four hours, though the bladders became not relaxed at all."

But the application of the gas thus generated to the purposes of economical illumination is of much more recent date; and the merit of introducing it is principally due to Mr. Murdoch, whose observations upon the subject are published in the "Philosophical Transactions" for 1808. He first tried it in Cornwall, in the year 1792; and afterwards in 1798 established an apparatus upon a more extended scale at Boulton and Watts' foundry at Birmingham; and it was there that the first public display of gas lights was made in 1802, upon the occasion of the rejoicings for peace. These, however, were but imperfect trials, when compared with that made in 1805 at Messrs. Philips and Lee's cotton mills at Manchester, and upon the results of which all subsequent procedures, with regard to gas lighting, may be said to be founded. The whole cotton mill, with many adjacent buildings, were illuminated with coal gas to the exclusion of lamps, candles, and other sources of artificial light. Nearly 1000 burners of different forms were employed; and the light produced was estimated equal to that of 2500 well-managed candles of six to the pound.

The most important and curious part of Mr. Murdoch's statement relates to the cost of the two modes of lighting—namely, by gas and candles—per annum. The cost of the coal used to furnish the gas, amounting annually to 110 tons, was £125; 40 tons of coals to heat the retort, £20; the interest on capital sunk, with due allowance for accidents and repairs, £550. From the joint amount of these items must be deducted the value of 70 tons of coke, at 1s. 4d. per cwt., amounting to £93, which reduces the total annual expense to £602; while that of candles to give the same light, would amount to £2000.

Such was the flattering result of the first trial of gas illumination upon a tolerably extensive scale. In regard to its efficacy, we are informed by Mr. Murdoch that the peculiar softness and clearness of the light, with its almost unvarying intensity, brought it into great favour with the workpeople; and it being free from the inconvenience of sparks, and the frequent necessity of snuffing, are circumstances of material importance, as tending to diminish the hazard from fire, to which cotton mills are much exposed.

When Mr. Lee was examined by Mr. Brougham, in 1809, before a Committee of the House of Commons, against the Gas Light and Coke Company's Bill, his evidence was then equally favourable. He said it gave no disagreeable smell; and when questioned as to the purity and goodness of the light, "I burn it," said he, "every night in my own house, instead of thirty pairs of candles." He further added that he found it perfectly wholesome, and that it was never complained of either in his own dwelling-house, or in the mill.

The President and Council of the Royal Society proved the high opinion which they entertained of the value and importance of Mr. Murdoch's communication upon the employment of the gas from coal for the purpose of illumination, by adjudging to him Count Rumford's gold and silver medals.

To prove that gas is economically applicable upon a small as well as a large scale, reference might be made to Mr. Cook's statement in the "Philosophical Magazine" for December, 1808, which, with some other amusing particulars, is noticed in the "Edinburgh Review," Vol. XIII., p. 477.

I have thought it right to state these particulars concerning the earliest trials of gas lights; and now, without adducing further evidence from those remote sources, I shall proceed to information gained at the establishments lately instituted in the Metropolis, and to that afforded by my own experiments. The apparatus required for gas illumination consists of retorts for the distillation of the coal, of condensers for the reception of the tar and ammoniacal liquor, of purifiers containing cream of lime, through which the gas passes, and is freed from carbonic acid and sulphuretted hydrogen, of gasometers or reservoirs with their main conduit pipes, and of the burners with their tubes and stop-cocks. Of the construction and expense of the whole of this apparatus, a tolerably correct estimate may be formed by consulting Mr. Accum's "Practical Treatise on Gas Light."

We are indebted to Dr. Henry, of Manchester, for some valuable researches concerning the composition of the aëriform products of several varieties of coal. ["Philosophical Transactions" for 1808.] He has pointed out the various composition of the gas at different periods of the distillation, and has shown the important influence of the circumstances under which the coal is distilled, upon the proportion of gas yielded, and its fitness for the purposes of illumination. This fact has lately attracted the notice of Mr. Clegg, the Engineer of the Gas Light Company, who has founded upon it several ingenious improvements in the construction of the retorts employed at the Westminster Gas-Works. Coal in large heaps, and gradually heated, affords less gas and more water and tar than when it is extended over a considerable surface, and suddenly brought to a red heat. It is also very advantageous to dry the coal before its introduction into the retort.

In a small apparatus, erected in the laboratory of the Royal Institution, we find that 4 lbs. of good Newcastle coal, introduced into the retort previously heated red, in a shallow iron pan, may be made to afford a produce of from 20 to 26 cubic feet of gas, consisting of—

Olefiant gas	8
Carburetted hydrogen	72
Carbonic oxide and hydrogen	13
Carbonic acid	4
Sulphuretted hydrogen	3
	100

The carbonic acid and sulphuretted hydrogen are separated by the lime in the purifiers.

The same quantity of coal introduced into the cold retort and gradually heated, afforded only 22 cubic feet of gas, consisting of—

Olefiant gas	5
Carburetted hydrogen	70
Carbonic oxide and hydrogen	18
Carbonic acid	6
Sulphuretted hydrogen	1
	100

The specific gravity of the former gas, that of air being 1000, was 560, and of the latter 555. The fitness of gases for the purposes of illumination is, generally speaking, directly as their specific gravity.

These experiments lead to the conclusion that a chaldron of good Wallsend Newcastle coals would afford from 17,000 to 20,000 cubic feet of gas; but the process of distillation as now carried on in the large establishments for lighting the Metropolis seldom affords a larger average produce than 12,000 cubic feet. There can, however, be little doubt that, by improvements in construction and management of the retorts, the highest of the above averages might be procured; and calculating upon this produce of gas, and upon the other substances yielded by the operation, we obtain a curious and striking result.

The average value of a chaldron of the best Newcastle coals is £3. The value of the products of its distillation is as follows:

1½ chaldron of coke, at 31s.	£1	18	9
12 gallons of tar, at 10d.	0	10	0
18 gallons of ammoniacal liquor, at 6d.	0	9	0
20,000 cubic feet of gas, at 15s. per 1000.	15	0	0
	£17	17	9

From the value of products must, of course, be deducted the value of the common coal employed in the furnaces to heat the retorts—amounting to about 5 chaldrons for every 25 chaldrons submitted to distillation; and the expense incurred by wear and tear, with the wages of the labourers, and, lastly, the interest upon

capital. Mr. Murdoch's estimate, already quoted, will be found pretty accurate upon these heads.

The tar is frequently employed for the production of gas, either by mixing it with small coal in the retorts, or by passing it through a red-hot tube. Every pound yields between 17 and 18 cubic feet, containing from 15 to 20 per cent. of olefiant gas. When, therefore, it has been cleansed by lime, it burns with a very brilliant flame, and is a most improving addition to common gas. Wigan and cannel coal yield the best and the largest proportion of gas for the purposes of illumination; but it is seldom it can be employed on account of its high price.

The burners or tubes whence the gas issues for combustion may be infinitely and tastefully varied. The varieties commonly employed are the batswing burner, and the argand burner. The former consists of a brass tube having a slit at its extremity about $\frac{1}{4}$ inch long and $\frac{1}{40}$ inch in width. The latter is composed of two concentric brass tubes about 2 inches long, closed at the bottom by a ring of brass, and at the top by one of steel perforated with some sixteen or eighteen holes of $\frac{1}{30}$ inch in diameter. The gas enters the cavity between the tubes, and issues from the circular row of apertures, where it is inflamed, and having a due supply of air within and without, burns very beautifully when a proper glass is placed over the burner. These burners, when carefully regulated, consume about 3 cubic feet of gas per hour, and give light equal to that of six wax candles. But it is requisite, on account of carelessness and mismanagement, to allow 4 cubic feet to each burner per hour. The batswing burner should not consume more than 3 cubic feet per hour.

At the three stations belonging to the Chartered Gaslight Company, situated in Peter Street, Westminster, in Worship Street, and in Norton Folgate, 25 chaldrons of coals are carbonized daily, which actually yield 300,000 cubic feet of gas, equal to the supply of 75,000 argand lamps, each lamp giving the light of six wax candles. But if the full proportion of gas were obtained—viz., 20,000 cubic feet from each chaldron of coals, then the produce should be 500,000 cubic feet, equal to the supply of 125,000 lamps of the same size, and the light afforded should equal that of 750,000 wax candles, instead of 450,000, which is the real produce. At the City gas-works, in Dorset Street, Blackfriars Bridge, the daily consumption of coals, for distillation, amounts, at present, to 3 chaldrons, which afford gas for the supply of 1500 lamps. So that the total consumption of coals daily in London, for the purpose of illumination, amounts to 28 chaldrons; and the number of lights supplied to 76,500.

Besides the different varieties of coal, some of which, as has been hinted, are much preferable to others, and coal tar, a useful gas may be procured from a variety of other substances; and in the laboratory of the Royal Institution we often feed the retort with waste paper, sawdust, pieces of wood, &c., and consume the gas for a variety of purposes, where oil was formerly employed.

The following are the results of some experiments upon these subjects compared with the produce from coal.

1. The retort was charged with 4 lbs. of coal. The quantity of gas amounted, after having passed the purifiers, to 20 cubic feet. The coke remaining in the retort weighed 2 lbs. 8·7 oz. The heating power of the gas-flame was compared with that of a wax candle, by ascertaining the time required by each to raise 2 oz. of water, in a thin copper vessel, from 55° to 212°. The flames were made as similar in dimensions as possible, and so placed that their points just touched the bottom of the vessel. The heating power of the candle being assumed as 1, that of the coal-gas flame was 1·5.

2. Four pounds of the dried wood of the common willow yielded 16 cubic feet of gas, and 14 oz. of charcoal remained in the retort. The gas burned with a very pale blue flame, and was unfit for the purpose of illumination, and contained no olefiant gas.

3. Four pounds of the wood of the mountain ash afforded 15½ cubic feet of gas, and 13½ oz. of charcoal. The flame was very pale and blue.

4. Four pounds of white birch wood gave 14 cubic feet of gas and 12 oz. of charcoal. The flame similar to 2 and 3.

5. Four pounds of hazel wood yielded 13¾ cubic feet of gas, and 12¼ oz. of charcoal. Its heating power was 1·2. It burned with a better flame than 2, 3, and 4; but the intensity was not sufficient for any useful purpose of illumination.

6. Four pounds of writing paper gave 18 cubic feet of gas, and the remaining charcoal, which beautifully retained the form and texture of the paper, weighed 11½ oz. The heating power of the gas was 1·6. It burned with a flame nearly approaching in illuminating power to that of coal gas.

These experiments, along with others which it is thought unnecessary to notice, prove that the gas from woods is not fit for the purposes of illumination, although as evolved during the production of charcoal, it may conveniently be consumed in the laboratory as a source of heat.

Respecting the advantages of gas illumination in streets, open places, large manufactories, &c., there can but be one opinion; but its introduction into dwelling-houses involves some more important considerations. It may be urged in its favour that the light is more equable, beautiful, and agreeable to the eye than that obtained from any other source; that superior cleanliness is attained, and the troublesome operations of filling and trimming oil-lamps are superseded; that there is no danger from sparks and snuffs, as where candles are employed; and that by closing the main pipe of supply, a certain extinction of all the lights throughout the building is insured.

The following are the principal objections that have been adduced. When the gas escapes unburned, its smell is extremely disagreeable; and this may happen either from some fault in the pipes or burners, or from a stop-cock connected with a burner being accidentally left open. In the latter case, the remedy is obvious; but in the former the escape of gas may prove very troublesome. It may be guarded against by employing double pipes; by carrying them as much as possible upon the exterior of the house; and, above all, by employing careful and good workmen in the construction of every part of the apparatus.

The idea of the explosions, in rooms lighted by gas, has frequently occurred; but when the probability of such an event is calmly considered, much of the alarm that it has excited must vanish. For the formation of an explosive atmosphere, a large quantity of gas must escape into an apartment which must be nearly air-tight; and in a room with an open chimney, and two or three doors and windows, it would scarcely be possible to obtain a dangerous mixture, though it might occur in a cellar or any other very small and close apartment. In a dwelling room, the gas would announce itself by its smell very long before any dangerous mixture could ensue, and the quantity of gas required would be very great. A room 12 feet square, or containing 1728 cubic feet of atmospheric air, would require an addition of 247 cubic feet of coal gas to render its atmosphere explosive. If we suppose a large argand burner accidentally left open in this apartment, whence gas is flowing at the rate of 4 cubic feet per hour, it would require sixty-two hours for the above quantity of gas to flow into the room, which also must be nearly air-tight. These circumstances can scarcely be supposed ever to occur. A very little attention to ventilation, which whenever gas is used should be strenuously insisted on, would remove all possibility of danger. But the best proof of the safety of gas illumination is that, notwithstanding the many thousand lamps nightly burning in London, six accidents only are known to have occurred,* and those of a very trifling and almost unimportant nature, though the pipes and lamps are generally very badly and very carelessly managed. In matters of this kind, facts, and not arguments, must be looked to for evidence.

It was my intention to have concluded this paper with some observations on the common construction of burners, and with an account of several important improvements lately made in the general apparatus of Mr. Clegg; but the hope of rendering my account of these subjects more correct and perfect than is at present in my power, induces me to defer it.

* Two of these arose from holes having been mischievously bored in the pipes of supply.

Dry Powder Fire Extinguishers.

Last March, the Home Secretary appointed a Committee—one of the members of which was Dr. J. A. Harker, F.R.S., of the National Physical Laboratory—to conduct experiments to test the value of dry powder fire extinguishers, as compared with water and other "first aid" appliances for extinguishing or effectively controlling fires such as are likely to be caused by bombs. Evidently no time was lost in getting to work, because experiments have been made, and a report prepared, which has already been issued by the Home Office. Details of the tests themselves it is unnecessary to give here; but the broad conclusions arrived at may be noted, inasmuch as the problem of extinguishing fires caused by bombs is liable to face anyone, and without warning. The substances tested were a particular make of dry powder extinguisher, water, and liquid chemical extincteurs. In one case, too, a supplementary test was also carried out with sand. It seems that while none of the agents employed could be said to have any material effect on the combustion of the bomb itself, the spread of the fire caused by the bomb was greatly limited, and in some cases totally prevented, by the application of water; whereas after the application of the dry powder the fire continued to burn, though at each application some temporary check to it was noted. Dry powder fire extinguishers generally contain as their main constituent bicarbonate of soda, which on heating gives off a certain quantity of carbon dioxide gas; but the Committee regard it as doubtful if the quantity so generated has a materially effective influence on the action of the powder as an extinguisher, except possibly in cases of small fires of a special nature and limited extent. Water being found far more effective, the method of its application was considered; and it appeared that a given volume of water applied as a jet from an extincteur was decidedly more effective than the same amount applied by buckets. A word of caution is, however, given as to the need for using only extincteurs of reliable makes. The application of sand was, weight for weight, less effective than the dry powder; but it was found that three buckets full (about 144 lbs.) extinguished a fire which three tubes of "Kyl-Fyre" (12 lbs. 15 oz.)—the dry powder experimented with—failed to do. In view of these facts, the Committee are confident that by far the best extinguishing agent is a plentiful supply of water applied in the manner most convenient, and that "the use of dry powder extinguishers is to be deprecated as not only giving a misleading sense of security, but being practically useless for extinguishing or effectively controlling fires likely to be caused by bombs."

It is estimated that more than 2000 new bye-product coke-ovens are either under construction or about to be begun in the United States.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Daylight Saving Bill.

SIR,—As a sequel to my letter of May 12, I may inform you that the consumption of gas in the whole month of May has been 7,259,501 cubic metres, against 7,122,673 cubic metres the same month of 1915—an increase of 1·92 per cent. Now it seems to me—because we had some fine as well as rainy weather—the effect of the Bill will be something less than 3 per cent.

Perhaps in England, with the higher consumption of gas for heating and cooking, it may be a little less; but leaving out of consideration some towns with special circumstances that influence the consumption of gas—as, for instance, Manchester and Birmingham—I do not think that Amsterdam, with a total of nearly 128,000 consumers and a consumption of gas per consumer of 726 cubic metres [25,635 cubic feet] per meter during the year 1915, is so far behind the average of English towns.

The whole number of consumers with prepayment meters was 77,412, with a consumption of 538 cubic metres [19,000 cubic feet] per meter during 1915. I believe these figures are not bad, in comparison with Great Britain.

J. VAN ROSSUM DU CHATTEL.

Amsterdam, June 2. 1916.

P.S.—The annual make for the whole of 1915 was 103,243,186 cubic metres per consumer—807 cubic metres, or about 28,500 cubic feet, each.

Toluol and the Limestone Process.

SIR,—In your current issue, I note Mr. Bell's figures, which were not available at or before the meeting. While accepting these under the conditions obtaining, I strongly adhere to my own, as nearly all the tests were conducted under my own eyes.

As against Mr. Bell's acknowledged status as an eminent carbonizing expert, I myself can claim only a limited knowledge and experience. But I suggest that his (Mr. Bell's) tests do not necessarily nullify mine; nor can either of us have had the last word on this matter, as there is no finality on tests of this nature.

The main object of all the three papers presented at our March meeting was to stimulate interest in the toluol, &c., process; and—by request, reluctantly acceded to—my own small part was to report whether, by special working here, the quantity was increased, and, if so, at what cost (if any). The details of carbonizing were necessarily given *en passant*, and were figures brought forward in an honest way, whether for or against the test.

It is, of course, possible that I may be wrong in my conclusions; but I do not think so, and am content to "carry on" as usual regardless of what others may say or do. Nothing else matters at present, except the successful prosecution of the war.

G. STEVENSON.

Long Eaton, June 3, 1916.

SIR,—In your leading article in the current issue of the "JOURNAL," dealing with the discussion on Mr. Stevenson's paper at the meeting of the Midland Association with reference to the application of limestone for increasing the production of toluol, you pertinently ask the question as to why all the necessary conditions exist in combination at Long Eaton and not elsewhere, and why the experience obtained at the various other works were unsatisfactory.

I desire to point out that in the pamphlets issued, dealing with the use of limestone in the carbonization of coal, it was stated that, since the general reduction in the illuminating power standard, many gas-works were using a much cheaper coal than the Durham, Yorkshire, and Lancashire natural gas coals; that many works with modern high temperatures were using cheap coals, high in oxygen and sulphur; and that it was to these undertakings the limestone process should more particularly appeal.

Especial attention was directed to the necessity of crushing the coal to a fine state, and to the use of finely ground, pure mountain limestone, to enable the best results to be obtained. Examples were set out in the pamphlet, showing results realized from coal which had been crushed from 2½ inches to dust; nuts between 2 inches and 1 inch in size; and coal crushed below ⅜ inch.

Mr. Stevenson has apparently been the only gas manager who has religiously carried out the conditions contained in the pamphlet; and this has enabled him to obtain satisfactory results.

The main cause of the failure of gas managers to obtain in the first instance the results claimed, is the fact that the limestone which was supplied to them for their experiments was not finely ground mountain limestone, but crusher dust. Arrangements, however, have been made whereby an ample supply of the right quality of ground limestone can be obtained from the Buxton Lime Firms, Limited.

Subject to this, and to the coal being crushed to a regular grade, in accordance with the instructions in the pamphlet issued by my Company, results quite up to those obtained by Mr. Stevenson will result.

A. ROLLASON.

Nottingham, June 2, 1916.

SIR,—The discussion on the above topic at the meeting of the Midland Association of Gas Managers will not, as you say, do much to hasten its application. It must not, however, be understood that the general process of liming the coal is a failure from the carbonizing point of view. It was a failure from the toluol point of view, except at Mr. Stevenson's works. That other works did not attain the results obtained at Long Eaton was because the conditions were not exactly the same.

The use of unburnt limestone, we learn, is limited to heavy charges of long duration, time and mass contact, and is not suited to light charges of short duration; so that only large works with the necessary machinery are able to work the process. If, therefore, managers of small and medium-sized works wish to adopt the liming system, they are confined to the Paterson process of using burnt limestone. Whether the toluol results are increased by using the burnt limestone remains to be seen; but that, from the carbonizing point of view, it is a great adjunct there is no shadow of doubt. The lime assuredly alters the complexion of the tar, and enables extremely high temperatures to be used without fear of ascension pipe and hydraulic main troubles.

The quicklime, presumably, liberates more ammonia from the coal, which helps to carry the tarry vapours in suspension, instead of their being decomposed and precipitated in the form of soot in the ascension pipes. The higher temperature permissible with the use of the lime is responsible for the increased make per ton rather than to any feature in the lime itself; and, further, there is not the liberation of CO_2 to the extent that there is with the unburnt lime. It is not necessary to use the quicklime with all coals, but is essentially applicable to dry coals. Wet coals do not require liming, as they contain an abnormal amount of water held mechanically, which prevents the tarry vapours from being baked and decomposed.

There is no need to use more than is sufficient to keep the pipes clear; from ½ to 1 per cent. being enough to ensure the chemical action. The coke is therefore spotless. The ash in the coke is increased in proportion to the quantity used, as shown by Mr. Stevenson's tests—viz., before using 2·9 per cent. of limestone the ash in the coke was 7·03 per cent.; after using, 9 93 per cent. It is therefore an advantage to use as little as possible, as the clinker is less, and there is less fear of retarding combustion in the furnace and, incidentally, of reducing the heats. The coal need not be crushed, but the quicklime can be "peppered" on to the charge just before it is put into the retort.

REGD. THOMAS.

Droitwich, June 2, 1916.

SIR,—I was much interested in reading the report of the discussion on the above subject at the recent Midland Association meeting. Having made a wide range of experiments on the influence of various bodies in the production of hydrocarbons, it is easy for me to understand why there should be a divergence of views in regard to the effects of the process. It is unfortunately a fairly-prevalent impression that all gas coals are capable of being dealt with successfully by processes such as the one referred to.

In the ordinary methods of working, differences are not strikingly apparent; but immediately new chemical or other influences are introduced, variations may be set up.

In carrying out experiments on a descending range of fuels—from gas coal to peat—the variations in the effect produced by the admixture of limestone, powdered lime, and granulated fire-brick are most marked. The best results have been obtained by the use of powdered lime; while the effects produced by granulated fire-brick and limestone are but little less.

The whole matter is one which affords a splendid argument for research, which you so ably advocated in a recent issue.

G. P. LEWIS.

429-431, *Bank Chambers, Holborn, June 2,* 1916.

Sulphate of Ammonia.

SIR,—I presume the following matter has escaped the notice of the Sulphate of Ammonia Committee; but I think your columns could not too widely advertise the observations in the "Journal of the Board of Agriculture" for the month of April, on "The Washing-out of Nitrate from Arable Soil during the Past Winter."

It is pointed out, on p. 22, that the superior solubility of nitrate of soda as compared with sulphate of ammonia renders it liable, in a heavy shower of rain, to being washed away into the ditches and entirely lost to the land.

The article—coming from Messrs. E. J. Russell, D.Sc., and A. Appleyard, M.Sc., at the Rothamsted Experimental Station, Herts—bears the very highest authority, and cannot be disputed. The inferiority of nitrate from this point of view has for many years been pointed out by me to my farmer friends, among whom I have cultivated the use of sulphate of ammonia.

Your readers may be interested to know that the chief difficulty I have had in persuading farmers to the use of sulphate of ammonia as purchased direct from the gas companies, arose from the fact that they always alleged they could buy the sulphate 10 per cent. cheaper. In one or two cases, I traced the supply to contractors who must have been taking sulphate on a large scale from the gas companies. I advised my friends to submit to analysis the sulphate of ammonia so procured with that which my Company had sold them, when they would discover the enormous amount of adulteration that had taken place in transit.

I regret that pressure of time has prevented my calling the attention of your readers to this important matter at an earlier date.

HY. E. JONES.

Palace Chambers, Westminster, S.W., May 30, 1916.

[Some extracts from the article referred to by our correspondent appear on p. 523 of to-day's issue.—ED. J.G.L.]

The Christiania Appointment.

SIR,—In the "JOURNAL" for May 2 a notice appeared about the change of management of the Christiania Municipal Gas-Works. The information published is apt to give an erroneous impression of what has really taken place. It is stated that "at length we are in position to congratulate Mr. J. G. Tooms on the confirmation of his appointment as Administrative Director of the Christiania (Norway) Gas-Works, in succession to the late Mr. O. Pihl." This is not the case.

At the meeting on the 26th of April of the Christiania City Council [Formandskapet] the filling of the vacancy in the directorship of the gas-works was considered. The following is a literal translation of the official report of the meeting concerning the case: "For the position as Administrating Director of the gas-works, there were at the expiration of the time for application five candidates. Of these, however, two withdrew their applications shortly after; and of the remaining

number, two were foreigners. In accordance with the recommendation of the Board of Directors and the Mayor [Magistraten], the Formandskap determined that none of the applicants ought to be appointed; but they decided that the appointment of Administrating Director be postponed, and that Mr. Tooms—in charge of the construction of the new gas-works—should be engaged until further notice to manage the operations of the present gas-works."

As President *pro tem.* of the Norwegian Gas-Works Association, I considered it only right to bring the above to your notice.

Bergen, Norway, May 25, 1916. B. K. SCHIELDROP.

REGISTER OF PATENTS.

Combustion of Gases and Vapours.

M'COURT, C. D., of Streatham Hill, and COMMERCIAL LABORATORIES, LIMITED, of Camberwell, S.E.

No. 6312; April 28, 1915. No. 7920; May 28, 1915.

This combined invention has reference to the combustion of a mixture of air and gaseous or vaporous fuel—such as coal gas, producer gas, coke-oven gas, or petrol vapour, "such mixture containing all the air necessary for the full and complete combustion of the gaseous or vaporous fuel constituent thereof." More particularly, the invention has reference to the combustion of a mixture of air and coal gas, such mixture containing all the air necessary for the full and complete combustion of the coal gas contained in it. Further, the invention has relation to the use of a mixture of air and gaseous or vaporous fuel in combustion apparatus, and to "the provision or construction of combustion apparatus of an improved character or nature for use with such a combustible mixture."

The claims made for the invention (the specification of which extends to fourteen print pages) are:

1.—In the combustion of gaseous or vaporous fuel, combustion apparatus wherein combustible mixture containing all the air necessary for the full and complete combustion of the fuel constituent at a very low pressure, and produced by the direct and injective action upon the atmosphere of a jet or jets of gaseous or vaporous fuel at the pressure ordinarily obtaining within the mains or pipes of a town's system of gas supply for domestic and general purposes, is supplied to a perforated slab or block at a pressure considerably below $\frac{1}{8}$ inch water-gauge over an aggregate cross sectional area of perforations of considerable extent, and the rate of supply of the mass of combustible mixture per unit perforation, and therefore the rate of generation of heat by its combustion per unit perforation, are both relatively small, so that the temperature of the exit ends of the perforations is not raisad to such a degree as to admit of the backward propagation of combustion.

2.—In the combustion of gaseous or vaporous fuel, combustion apparatus as claimed in Claim 1, and comprising (in combination) a perforated slab or block of refractory material, an iron casting or the like adapted to receive and hold the slab or block—the slab or block constituting, with the casting or the like, a casing or chamber, and forming one wall thereof, a venturi tube or the like connected at one end with the casing or chamber and having at the other end a fuel jet or fuel jets in connection with a supply of gaseous or vaporous fuel at domestic pressures—the arrangement being such that the optimum amount of air from the atmosphere is driven into the casing or chamber by the jet or jets of gaseous or vaporous fuel at domestic pressures, and forms combustible mixture containing all the air necessary for the full and complete combustion of the fuel constituent and at the very low pressure resulting from the direct and injective action of a jet or of jets of gaseous or vaporous fuel at domestic pressures upon the atmosphere; the combustible mixture passing through the perforations and being burnt on the exit surface of the slab or block.

Prepayment Meters.

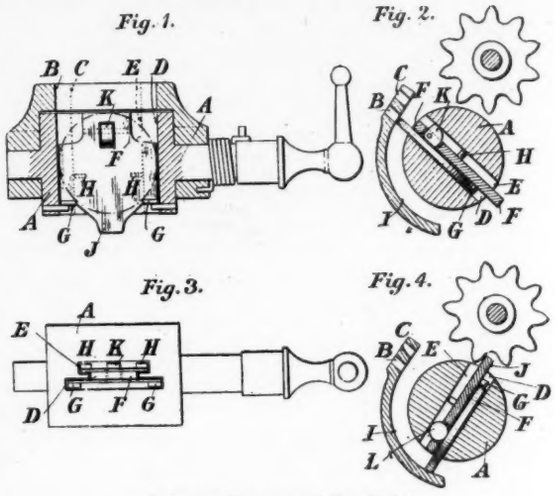
COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATÉRIEL D'USINES À GAZ, Paris.

No. 6548; May 1, 1915. Convention date, May 2, 1914.

This invention relates to prepayment mechanism for meters in which the coin, on being inserted, causes a tooth or driver to protrude from the rotary barrel, and which (when the barrel is turned) operates the mechanism. The arrangement is adapted for use with coins of different diameters by providing more than one slot in the barrel and a similar number of stops so placed on the driver that any one of the coins provided for (if inserted into its appropriate slot) will cause the driver to protrude to the correct degree.

Several constructions according to the invention are illustrated in the specification. Fig. 1 is a longitudinal section of one form of barrel for prepayment meter mechanism. Fig. 2 is a cross-section—the barrel being shown at rest at the moment of introduction of a coin. Fig. 3 is a plan of the barrel alone. Fig. 4 is a cross-section like fig. 2, but after the barrel has been rotated for the purpose of operating the mechanism.

The mechanism shown is designed to be operated by two coins of the same value, but of different diameters—for instance, by a bronze coin of 10 c., and a nickel coin of the same value. To this end, the casing of the barrel A is provided with two openings B C, the dimensions of which are calculated to suit the two kinds of coins to be used. The barrel itself is provided with two slots D E, of dimensions corresponding to the openings B C, and separated from each other by a movable plate F, constituting the driver, intended to operate the mechanism. This plate is provided on its two faces with stops G H, with which the coins introduced into the apparatus engage. The stops are so arranged that the large coin penetrates to a greater depth into the barrel than the small one—the edges of the two coins, opposite the operative end of the driver F projecting to one and the same extent, so as to engage with a fixed arched or curved guide I on the casing. At its end opposite the openings for the introduction of coins, the driver terminates in a tongue J, which projects out of the barrel to a certain extent when a coin is introduced into the barrel.



A French Prepayment Gas-Meter.

If the barrel is turned without any coin having been introduced, the driver will not exercise any action, as, being deprived of the point of support afforded to it by the coin during normal working, it cannot raise the arm of the pawl, which prevents the tongue from projecting out of the barrel to the extent required for engaging with the teeth of the ratchet wheel.

By giving a certain play to the driver F across the recess, it is possible to avoid the simultaneous introduction of a large and a small coin into the barrel. In fact, the introduction of the first coin, according as it is effected through one or the other orifice, brings about the raising or lowering of the driver, so that the space left at the side opposite to the coin introduced is not sufficient for a second coin.

The same result can be obtained by a pivoted cam K or a roller, ball L, &c., which, according to the direction in which it is pushed by the action of the coin introduced, will always close the conduit opposite the coin, as shown in figs. 2 and 4.

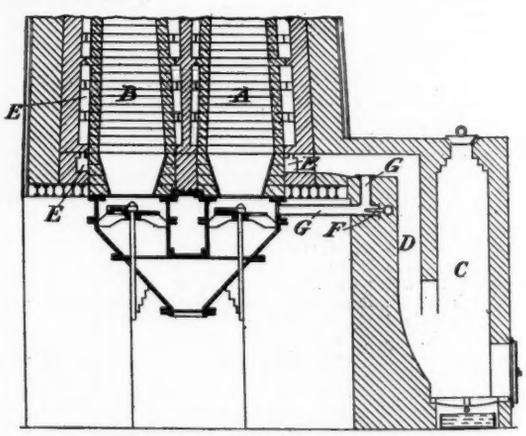
Whatever be the diameter of the coin utilized, the same barrel and the same driver can always be used. Only the stops intended to keep back the coin vary in position.

Distilling Shale or Coal for the Production of Oil or Illuminating Gas.

FELL, J. W., of Sydney, New South Wales.

No. 6613; May 3, 1915. Convention date, Jan. 5, 1915.

This invention, relating to the distillation of shale or coal for the production of oil or illuminating gas, is of the kind in which there is injected into the retort a stream of producer gas, water gas, or the like in a heated condition.



Fell's Shale and Coal Distilling Plant.

A vertical section is given of the lower parts of a pair of retorts A B for distilling shale and of a generator C for making producer or water gas. D is a passage or flue through which the gas generated in C passes on its way to the retorts. The gas as produced will necessarily be in a heated condition, and will pass directly through the flue into the annular passages E, which surround the retorts, and which are so arranged that the hot gas shall take a serpentine course round and round the retorts—thus keeping the material within in a heated state. As the heated gas from the generator approaches the passages E, a portion of the gas will be induced, by a steam-jet F, to enter the bye-pass G, and

be injected to a point at the bottom of the retort A. It is important that the gas from the generator C should be entirely excluded from contact with the external atmosphere, so that when it enters the material within the retort it is in a heated state. There will be a draught or current, partly caused by exhaustion and from other causes, passing upwards through the material being treated in the retort; and this current will cause the heated gas from the generator to rise through, and thoroughly permeate, the mass of material within the retort, thus increasing its capacity for distillation.

With a coal-gas retort, the mechanical arrangement would be modified; but the principle of causing the heated gas to pass through the mass of material being treated would remain the same.

If the gas to be introduced into the retort be in a cold state, it will be necessary to heat it up to the desired temperature before it is permitted to enter. This may be effected by employing a superheater intermediate between the holder or generator and the retort, so that the gas when it enters the retort is in a properly-heated state, but entirely free from the admixture of any external atmosphere. The heating chamber, in this case, would be as near as possible to the retort into which the heated gas is to be injected or inducted.

A similar and parallel bye-pass to D will be provided to the retort B, so that the heated gas from the generator may operate upon the mass of material in it, the same as it would in the retort A.

Cameras for Recording the Readings of Meters.

A. Frisch and Co., of Zurich.

No. 7404; May 17, 1915. Convention date, May 18, 1914.

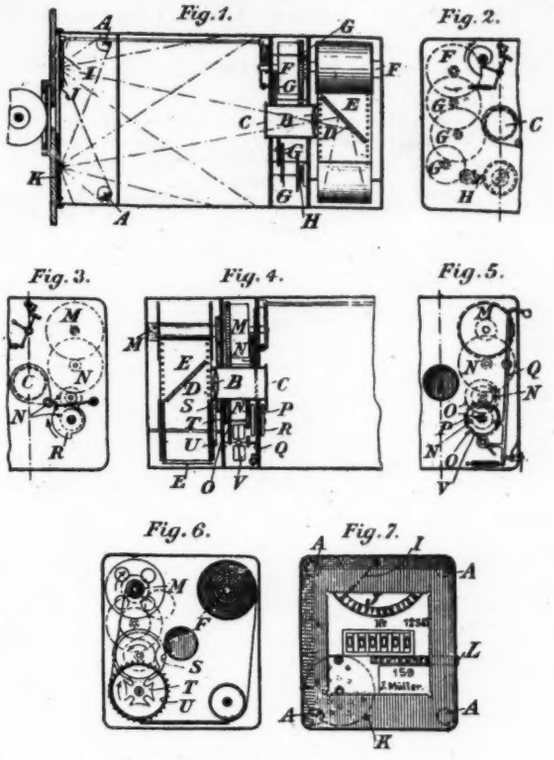
This invention comprises apparatus embodying a camera, clockwork for operating the object glass shutter and for changing the sensitized material, time clockwork for fixing the time of photographing, and a device for releasing the camera clockwork and lighting-up the source of light.

Fig. 1 is a vertical longitudinal section through the centre of the camera; figs. 2 and 3, the left and right halves of a cross-section of fig. 1; fig. 4, a portion of the front half of the longitudinal section, not visible in fig. 1; fig. 5, the right half of a cross-section of fig. 1; fig. 6, a cross-section of fig. 4; fig. 7, a section of fig. 4 with a view of the surface to be photographed.

The apparatus illustrated comprises three main parts: (*a*) The optical device, comprising the electric lamps A, the object glass B, the object glass shutter C, the flat mirror D, and the film band E. (*b*) The time clockwork, comprising the spring barrel F, wheel train G, balance and escapement H, hour hand I and dial J, day disc K, and month strip L. (*c*) The camera clockwork, comprising a spring barrel M, wheel trains N and O, escapement disc P, a switch lever Q for the release and for the control of the lighting current, cam disc R, single tooth wheel S, a Maltese cross T, a film feed drum U, and a fly V. As an accessory may also be used an electric pocket battery to be connected to the terminals of the lamps.

By pressing a button on the lever Q, the escapement disc D and the fly V are released and rotated by the main spring through the wheel trains N and O. After the disc has completed one revolution, a pin provided on the lever engages a notch under the action of a spring and stops the rotation. In the meantime, the fly makes a large number of revolutions, and is finally stopped by another pin, also provided on the lever Q. On the turning of the lever releasing the camera clockwork, contacts close the lighting circuit and bring about illumination of the surface to be photographed. When the cam disc R is rotated, a pin with which it is provided is raised for a time and maintained in a raised position; so that the lever shown is swung upwardly and rotates with its teeth on the free end of the tooth segment rigidly connected to the shutter C. The latter is thus turned downwardly, whereby the shutter of the object glass B is opened. The time of exposure is regulated by a corresponding regulation of the speed of the camera clockwork, in such a manner that the picture projected by the object glass and the flat mirror D on the film band E has the desired sharpness.

During the second half of the revolution of the cam disc R, the single tooth wheel S, driven at the same speed as the cam disc from the spindle of the escapement disc, also moves and advances the drum U (in the manner used in cinematographs), and, by means of the Maltese cross T, by a little more than the length of one picture. After the escapement disc has completed one revolution, the lever Q returns to the initial position; the camera clockwork is stopped; the lighting current broken; and the film band E locked in a position ready for a new photograph.



Frisch's Gas Meter Recording Camera.

Hydraulic Mains for Gas-Retorts, Coke-Ovens, &c.

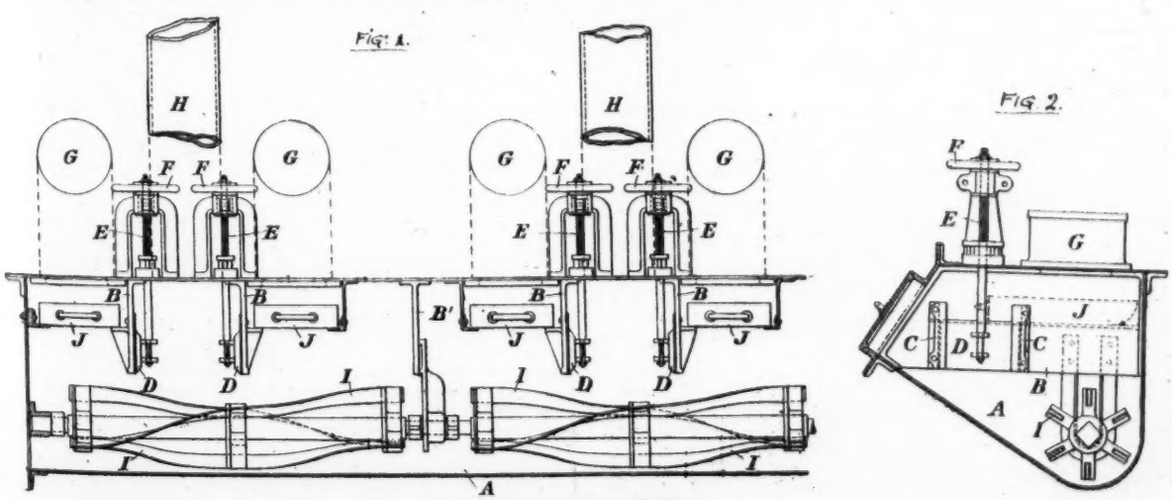
Leech, W. J. B., and Payne, C. R., of Leeds.

No. 10,293; July 15, 1915.

This invention consists in an "improved form of anti-dip sealing device, whereby dip-pipes are entirely dispensed with and whereby any particular set of retorts can be sealed independently of the others."

The invention, as applied to a hydraulic main with helical agitator devices rotating in the bottom, is illustrated in a partly sectional longitudinal elevation and partly sectional end elevation.

The hydraulic main A is divided into any required number of compartments by upright cross plates B B¹ fixed in the upper part of the main and sealing into the tar and liquor in the bottom of it. Each cross plate B is provided with an opening having an iron frame C in which is fitted an adjustable upright slide or valve D, which is controlled from the top by a screw E and hand-wheel F, so that only the particular retorts or coke-ovens which are required to be discharged and recharged at the time are put under seal. This arrangement prevents both the admission of air and the loss of gas caused by sealing the whole of the retorts or ovens connected to the hydraulic main during drawing and charging operations. G are the gas-inlet pipes; H, the outlet pipes; I, the rotatable helical agitators; and J, removable pans which may be fitted in the upper part of the main for the purpose of intercepting and collecting solid impurities delivered to the main by the gas-inlet pipes.



Leech and Payne's Anti-Dips.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:

Bills brought from the Commons, read the first time, and referred to the Examiners: Local Government (Ireland) Provisional Order (Gas), Tynemouth Corporation.

Bills read the third time and passed: Colchester Gas, Ferndale Gas, Hornsey Gas, South Metropolitan Gas (with amendments), Yeadon Water.

The opposition to the Folkestone Gas Bill having been withdrawn, it has been committed.

Bill reported, with amendments: Newcastle-upon-Tyne and Gateshead Gas.

The Imperial Continental Gas Association Bill has received the Royal Assent.

HOUSE OF COMMONS.

The following further progress has been made with Bills:

Bill brought from the Lords, read the first time, and referred to the Examiners: Colchester Gas, Ferndale Gas, Hornsey Gas, Yeadon Water.

Bills read the third time and passed: Imperial Continental Gas Association [Lords], with amendments; Local Government (Ireland) Provisional Order (Gas), Tynemouth Corporation.

Standard of Calorific Power Bill.

A Bill "to authorize as respects gas undertakings the substitution of a standard of calorific power for a standard of illuminating power," was presented last Thursday by Mr. Pretyman. The provisions of the Bill are given on p. 500 of this issue.

Pooling of Railway Waggons.

On Monday last week, Mr. ANNAN BRYCE asked the President of the Board of Trade: (1) What railway companies had so far pooled their waggons; what had been the result in diminishing congestion of transport; and whether he was taking further steps in the direction of further pooling. (2) Whether his attention had been called to a memorandum from the Traders' Traffic Association regarding the shortage of railway waggons; and whether, in the absence of a complete system of waggon pooling, he was prepared to take steps, and, if so, what, to meet the difficulty?

Mr. RUNCIMAN replied that arrangements for the pooling of their waggons had been brought into operation between the Great Central, Great Eastern, and Great Northern Railway Companies, and also between the Great Western, Lancashire and Yorkshire, London and North-Western, Midland, and North-Eastern Companies. He understood that in both cases the result had been satisfactory. Similar arrangements would shortly be in force between the Caledonian, Glasgow and South-Western, and North British Companies. He had not yet seen the memorandum referred to by Mr. Bryce, but any specific cases of difficulty which might be brought to his notice would receive careful consideration.

Answering Sir W. Essex, Mr. Runciman said that, after looking very carefully into the subject, he had come to the conclusion that there would be no saving or increased efficiency by pooling privately-owned waggons.

Coal Prices.

On Wednesday, Mr. NEEDHAM asked the President of the Board of Trade whether his attention had been called to the statement made at a recent conference held in the Manchester Town Hall that coal was going from the Manchester district to Durham and to Newcastle, and that coal was coming from these districts to Lancashire; whether this movement had close connection with the Price of Coal (Limitation) Act; and what steps he would take in the matter?

Mr. PRETYMAN (the Parliamentary Secretary) replied that his attention had been called to the statement. In the only important case of which he was aware in which Northumberland coal was being sent to Manchester, he did not think that any question of price was involved. He could not trace having received any particulars of coal from the Manchester district being sent to Durham and Newcastle.

Mr. PRINGLE asked Mr. Pretyman if he would make inquiries, remarking that Mr. Needham had information showing that the coal had passed. Mr. Pretyman replied that they could not trace any such passage of coal. Inquiries had been made.

Overcharges under the Price of Coal (Limitation) Act.

On Thursday, Sir A. MARKHAM asked the President of the Board of Trade if he would say how many convictions of colliery owners had been secured for breaches of the Coal Price (Limitation) Act, and the amount of such fines; and would he at the same time state how many hundreds of communications have reached the Board of Trade complaining of overcharges and breaches of the Act?

Mr. PRETYMAN (the Parliamentary Secretary of the Board of Trade) said he was not aware of any convictions under the Price of Coal (Limitation) Act. Numerous complaints had been made to the Board of Trade, and had been investigated where it had been possible to obtain sufficient particulars. In many cases the sellers had been able to justify their charges. In others, the price had been revised at the request of the Department.

Sir A. MARKHAM also asked: (1) How many applications (if any) had been made by colliery owners to the Board to increase the sum of 4s. provided under the Price of Coal (Limitation) Act, 1915; had such requests been acceded to; what substituted prices (if any) had he sanctioned; how had he arrived at such substituted prices, seeing that there was not a single official at the Board of Trade who had any knowledge of colliery costs. (2) Seeing there is not a single permanent official at the Board of Trade who has any knowledge whatsoever of the coal trade, was he aware that the Home Office had a number of officials fully acquainted with, not only the technical management of mines, but with the buying and selling of coal and the cost of producing coal; and would he, therefore, advise the Prime Minister that, in the interests of efficiency, the Price of Coal (Limitation) Act, 1915, should be administered by the Home Office?

Mr. PRETYMAN answered that the standard amount under the Price of Coal (Limitation) Act was increased to 5s. for the Forest of Dean district in September last. Applications had been since received for increases in respect of three other districts. Two were refused, and the third was under consideration. Such cases were decided on an examination of the evidence submitted. The considerations to be taken into account were not wholly of a technical nature, but where expert advice was necessary it was obtained. This was true of the administration of the Act generally, and he did not think that the alteration suggested was necessary.

Sir A. MARKHAM further asked the President of the Board of Trade whether, seeing that the Price of Coal (Limitation) Act, 1915, was being ignored by many colliery owners, and that he was aware of this fact, he would give the reasons why he refuses to institute proceedings against persons breaking the law; whether he was aware that, following the official statement that the Act does not impose upon the Board of Trade, nor did the Board ever undertake, the duty of prosecuting in cases where the allegation was made that illegal prices had been charged, many colliery owners were now ignoring the Act and refusing to supply persons who refused to contract out of the Act; and would he, seeing that the Act was passed at the instigation of large numbers of private members, take steps to see that the Act was obeyed, and prevent the law being brought into contempt?

Mr. PRETYMAN replied that the Board of Trade could hardly themselves institute proceedings under the Price of Coal (Limitation) Act, as the Court had to refer certain questions to them for decision. He should be sorry to think that many colliery owners were ignoring the Act. Irregularities no doubt occurred from time to time, and where such cases were brought to their notice the Board had, as a rule, been able to put matters right. Cases of refusal to supply could be dealt with by the District Coal and Coke Supplies Committees.

Sir A. MARKHAM: Is the Board fully aware that where colliery owners decline to supply coal at the prices under the Act the owners say they have no coal to sell, and therefore the consumer has to pay these prices?

Mr. PRETYMAN: The people who are aggrieved can take proceedings under the Act. It is not for the Board of Trade to prosecute.

Damaged Electric Lamps in Dublin.—Details have been submitted to the Dublin Electricity Committee of the damage caused to the arc lighting system during the recent outbreak. Most of the damage was done, apparently, by rifle fire; and in the majority of instances the lamps were beyond repair. The total cost of making good this class of damage was estimated at £1050. It was reported that the electric lighting accounts of consumers whose premises had been destroyed by fire amounted for the past twelve months to £8072.

The Past Year at Wolstanton.—For the year lately ended, the Wolstanton Urban Council's gas undertaking shows a net profit of £739. The Council have decided to grant an increase of £50 per annum, with coal and gas, to Mr. Charles Loveridge, the Gas Manager. It has been resolved to increase the price of gas by 2d. per 1000 cubic feet as from June 30. The increase in cost of coal last year was over £1000. A war bonus of 1s. 9d. per week has been granted to the gas employees, making, with the 1s. 3d. per week granted last year, a total of 3s. per week.

Biddulph Gas-Works and the Rates.—On the minutes of the Gas Committee being presented at a meeting of the Biddulph Urban District Council, Mr. Findlow said a few hints had recently been thrown out with regard to the gas-works receiving help from the rates. As Chairman of the Gas Committee, he thought it was only fair to point out that the works were bound to come on the rates for a few years. There had been no secret about it. At present the undertaking was working under grave difficulties; but with all the drawbacks, he thought they had done fairly well. He felt confident that there would come a time when the undertaking would help to relieve the rates.

Growth of the Bradford Water Undertaking.—In recognition of fifty years' faithful work for the city, the Lord Mayor of Bradford (Mr. Thomas Howarth), on behalf of the Streets, Improvement, and Water Committees of the Corporation, presented the Assistant Town Clerk (Mr. W. T. Croft) with a silver dessert service. In the course of his acknowledgment, Mr. Croft said he firmly believed that these two Committees had done a great deal towards making Bradford what it was to-day. The revenue from the water undertaking was now about five-and-a-half times larger than it was when he first entered the Corporation service. Though water had not gone up in price, everything else had; and this was a fact which the Corporation might before very long have to take into consideration.

Birmingham Water Supply.—The revenue account of the Birmingham Corporation water undertaking for the year ended March 31 shows a gross profit of £265,364, as against £217,101 for the previous year, or an increase of £48,263. Interest charges have increased, owing to the higher rates paid; and the result of the working for the year is a deficiency of £62,241, to be provided for. There was an increase of 6·59 per cent. in the average daily distribution of water. The provision of the third line of pipe on the Welsh aqueduct, which, under pre-war conditions, was expected to be required for use in the summer of 1918, must be deferred; so that, with a largely increased growth in demand, the Committee are faced with a postponement of the increased supply. They say they cannot but regard the future with anxiety, and are bound to warn the Council that, under certain very probable circumstances, there will be a considerable shortage of supply in the near future. The Committee are taking special steps to protect the Welsh aqueduct as far as possible from the unfortunate breakdowns causing partial or total interruptions of supply which have frequently occurred at the times of maximum demand.

MISCELLANEOUS NEWS.

BIRMINGHAM GAS DEPARTMENT REPORT.

In the report which they will submit at a meeting of the Birmingham City Council to-day, the Gas Committee state that, in view of the necessity for providing further carbonizing plant to meet the increasing demands upon the department for gas, they have decided to fill up the available space in No. 2 retort-house at the Nechells works with plant of the horizontal type, with stoking machinery. Every effort will be made to complete the plant for next winter's output, though there is great difficulty at the present time in obtaining delivery of apparatus and materials. The increase in the quantity of gas sold during the year ended March 31 was 908,740,700 cubic feet. The huge increase during last winter occasioned some anxiety to the Committee, who appealed to consumers to assist them in maintaining the supply to munition factories by exercising the strictest economy in the use of gas for all purposes. The Committee thank the consumers for their ready response to the appeal, which resulted in relief being afforded to the department at a time when their resources were being taxed to the utmost. The accounts for the year ended March 31 show a surplus of £26,274 to be paid to the Finance Committee in aid of the borough rate of the city.

The following are comparative statements of the trading results for the years ended March 31, 1915, and 1916:—

	1915.		1916.
Gas sold . . . . cubic feet	9,887,664,900	..	10,796,405,600
New services laid	5,698	..	4,085
Cooking and heating stoves sold	1,051	..	1,474
Cooking and heating stoves on hire at March 31.	63,985	..	67,696
Cookers supplied with prepayment meters at March 31 . .	91,841	..	95,193
Prepayment meters fixed at March 31	99,101	..	101,855

NOTTINGHAM GAS UNDERTAKING.

Remunerative Year's Work.

Indicative of substantial results, the annual report of the Nottingham Corporation Gas Committee, prepared for presentation at yesterday's meeting of the City Council, contains much interesting information. Despite abnormal difficulties, the gross profit during the last twelve months has fallen short by £4196 only of that of the preceding year—the totals for this and the previous annual period being £125,887 and £130,083 respectively. The advance of 12½ per cent. which was made in the price of gas during the period under review accounts largely for the present satisfactory position; the enhanced rate having resulted in an addition of £17,388 to the revenue. The Committee also enjoyed the advantages of many coal contracts which had been placed well ahead, as also for the sale of coke and their other residuals. But these have now been practically terminated; and the outlook cannot therefore be regarded with the same degree of equanimity. Meanwhile the undertaking has been enabled this year to contribute £35,000 in relief of the rates, compared with £39,000 in the periods immediately preceding; while the reserve fund, which has been increased from £180,854 to £186,479, affords further evidence of general financial stability.

The Committee's report, which is signed by Alderman A. Ball, J.P., as Chairman, states that the quantity of gas sold during the past year was 2,151,028,500 cubic feet, against 2,181,615,400 cubic feet the previous year; being a decrease of 30,586,900 cubic feet. There was a reduction on public lighting of 81,772,100 cubic feet; but there was an increase in the private consumption of 51,185,200 cubic feet. The total income amounted to £403,933, and the expenditure to £278,046, showing a balance of £125,887 carried to profit and loss account, to which is added £10,708 brought forward from last year's account and £4341 for interest. After charging annuities, interest on loans, sinking funds, and depreciation of stoves, there remains £85,566 at the disposal of the Council.

The prices and deliveries of coal, fire-clay materials, chemicals, and general stores have been, and still are, a source of great anxiety to the Committee; and the position is becoming more critical week by week. Good prices have been realized for coke, sulphate of ammonia, crude carbolic, and crude cresylic; but pitch and creosote have been almost unsaleable, and heavy stocks have accumulated. No good purpose would be served by attempting a forecast of the conditions which will probably exist during the next year; but the Committee recognize that serious difficulty will be experienced in obtaining the requisite materials to carry on gas-making operations, and, further, that the financial returns will be very adversely affected. It may be noted that all old contracts for the purchase of coal, &c., and the sale of coke and other residuals have, with one or two minor exceptions, now been completed. It is unfortunate that the erection of the vertical retorts at Basford has been delayed by shortage of materials required for the general structure, as it had been anticipated that the installation would have effected economy of materials and labour during the present crisis.

Substantial advances of wages and war bonuses have been granted to the workmen; the cost being approximately £9000 per annum.

Report of the Engineer and General Manager.

The fifth annual report of Mr. John Wilkinson, the Engineer and General Manager, states that during the year ended March 31, 181,177 tons of coal and 70,218 gallons of oil were utilized in manufacturing the following products: Coal gas, 2,195,674,000 cubic feet; water gas (equalling 1·15 per cent. of the total gas made), 25,529,000 cubic feet, making a total of 2,221,203,000 cubic feet; coke (for sale), 79,165 tons; tar, 10,634 tons; ammoniacal liquor (of 10 oz. strength), 27,693 tons. The quantity of tar manipulated at the Giltbrook chemical works was 1,901,412 gallons.

The sales of gas during the year were: Ordinary consumers, 1,572,095,300 feet; prepayment consumers, 553,731,700 feet; and public lamps, 25,201,500 feet—total, 2,151,028,500 cubic feet. These figures indicate a decrease of 30,586,900 cubic feet, or 1·4 per cent., when compared with the sale of gas (2,181,615,400 cubic feet) for the previous year.

The receipts for gas were: Year ended March 31, 1916, £285,332; March 31, 1915, £265,985—increase, £19,347. The gas unaccounted for during the year was 70,174,500 cubic feet, or 3·16 per cent., as compared with 96,390,600 cubic feet, or 4·23 per cent., for the previous year. The sale of gas per ton of coal carbonized was 11,736 cubic feet, as compared with 11,675 cubic feet for the previous year.

During the year, 706 additional consumers were connected to the mains, thus making a total of 83,133 consumers at March 31. The average consumption per consumer equalled 25,286 cubic feet, compared with 24,859 cubic feet the previous year. The total length of mains laid at March 31 was 407·20 miles; 1·36 miles having been added to the canalization during the year. At the end of the financial year, 43,353 prepayment meters were in operation. The position of gas in regard to its application for trade and domestic purposes, other than lighting, has been maintained; and on March 31 there were in use about 34,504 gas-cooking stoves, 18,631 fires, and 854 gas-engines, Of the 34,504 cookers fixed, 9855 were rented from the Department, and 23,835 supplied rent free with automatic meters. There are also in use numbers of other appliances of almost every description.

Mr. Wilkinson observed that prices of coal and other materials largely used on gas-works continued to advance throughout the year; and the expenditure shown in next year's accounts will unquestionably reach an alarming amount. The markets for coke and sulphate of ammonia have been good, and appear likely to remain so during next year; but there is no improvement in the outlook either for pitch or creosote. The following are the comparative expenditures for coal, and receipts for residuals during the last three years:

	Expenditure for Coal.		Receipts for Residuals.
1916	£124,455	..	£102,810
1915	£103,626	..	£86,581
1914	£111,013	..	£94,326

The actual result of the revenue account for the year is: Tota receipts, £403,933; total expenditure, £278,046; gross profit, £125,887. The gross profit for the previous year was £130,083, and £131,917 for the year ended March, 1914.

Annexed to Mr. Wilkinson's report are tables showing the development of the undertaking during the last ten years, and the comparative workings per ton of coal and per 1000 cubic feet of gas sold for the years ended March, 1915 and 1916. Whereas in 1915 the coal used for manufacturing purposes cost £103,626, or 11s. 1·10d. per ton last year it entailed an expenditure of £124,455, or 13s. 6·97d. per ton. Rates and taxes showed a heavy increase in the two years of from £26,872 to £36,407. The capital account discloses that the total value of the annuities remaining is £309,550. To this has to be added: Loan capital, £320,667; debenture capital, £55,521; and consolidated stock, £450,997—making the total stock invested in the undertaking £1,046,735. The renewals account at the end of March represented £106,556 in hand; the sinking fund account (Annuities Act, 1905) £50,251; sinking fund account (loan and debenture stock), £33,810; sinking fund account (consolidated stock), £172,303; reserve fund and rest account, £186,479; and annuity redemption fund account, £20,031. The figures indicate a continuance of the sound policy which has characterized the present *régime*, of substantially augmenting the reserves, while making adequate provision for the special expenditure which was designed to bring the works thoroughly up to date.

HINCKLEY GAS-WORKS REPORT.

Presenting his annual report to the Hinckley Urban District Council, Mr. Fred Lee (the Manager) stated that the expenditure on capital account was £952, and had been met out of profits. The net profit for the year was £1835, a decrease of £165 compared with the previous year. The receipts for gas were £1208 more. Coal had cost £10,441, or £1 1s. 2d. per ton, compared with 16s. 7d. In 1907, coal was only costing 13s. per ton.

The coal used totalled 9850 tons; and the gas manufactured showed an increase of 5,123,000 cubic feet. The total gas sold was 109,035,500 cubic feet; 1·93 per cent. being unaccounted for. There was a decrease in the gas used in houses and shops, the result of the lighting restrictions; but there was an increase of 5,173,000 feet in the gas used for power—supplies for this purpose being charged at a low rate. The number of meters in use was 3578; being an increase of 100 during the year, while they had now 2000 cookers on hire. There was an increasing demand for gas for heating purposes, especially as labour was so difficult to obtain, and the price of coal so high. Though the price of gas was increased by 2d. per 1000 cubic feet in July last, the average increase for the year was only 1·10d.

In moving the adoption of the report, Mr. W. H. Bott (the Chairman of the Gas Committee) said the Committee considered the result of the year's working as very satisfactory, and much better than was anticipated. The price of coal was still very high, being 4s. 7d. per ton over the previous year. In 1907, when coal was 13s. per ton, gas was sold at 3s. per 1000 feet; and in 1916, with coal at 21s. 2d., the price of gas was 2s. 8d. The price of coal for the current year would be still higher; but the Committee did not anticipate that it would be necessary to increase the price of gas. The debt on the works was now £24,571, which was equal to 4s. 6d. per 1000 cubic feet of gas sold; but it was worthy of note that the cash and stocks in hand, over the amount owing for goods, was £9215, which really left the net liability £15,356. The increase in the gas used was chiefly

for power; and this was sold at so low a rate that there was little or no profit under present conditions. The thanks of the Council—and, indeed, of the town—were due to the Manager and his assistants for the splendid work of the past year.

Mr. T. Ancott agreed that the works had been excellently managed. He recalled the time when they were offered to the old Local Board for £17,000, *plus* £3000 for a new holder. They were some time afterwards purchased by the Council at £10,000 beyond this figure. The works were now in first-rate condition, and if in the market to-day would probably fetch £100,000 or £120,000, which would pay off the whole of the debts of the town.

Other councillors having referred to Mr. Lee's excellent services, the report was approved.

WEST BROMWICH GAS ACCOUNTS.

The accounts of the West Bromwich gas undertaking for the past financial year show that the total income was £75,199, an increase of £12,826 when compared with the previous year. The gross profit amounts to £13,183; and after payment of interest and sinking fund charges, the net profit is £2845, as compared with £1307. The balance is being carried forward unappropriated. The sales of gas during the year were 395,283,686 cubic feet, including public lighting (a decrease of 1,664,416 cubic feet); and the amount of the gas-rental was £50,907, as compared with £44,216 (an increase of £6691). The Gas Committee recommend that the salary of Mr. W. H. Johns, the Gas Engineer, be increased from £500 to £550 per annum, as from the 1st inst.

LANCASTER CORPORATION GAS-WORKS.

A Successful Year.

The annual report of Mr. C. Rhodes Armitage, the Engineer and Manager of the Lancaster Corporation Gas-Works, shows that the total receipts were £35,181, and the expenditure £25,917, leaving a gross profit of £9263. Out of this sum, £2584 has been paid for interest on stock and mortgages, £2264 has been added to the redemption fund, and £1006 has been paid for income-tax, which leaves a net profit of £3408 to be transferred to the reserve fund.

The total sales of gas, exclusive of that supplied to public lamps, were £22,985, an increase of £3303. Residuals realized £10,773, equal to 66·85 per cent. of the cost of coal. The average price received per 1000 cubic feet of gas sold was 2s. 0·75d.; the net profit being 3·67d. per 1000 cubic feet. The total cost of coal was £16,115, an average of 16s. 6·30d. per ton, as against 13s. 5·63d. in the previous year.

Nothing has been added to capital account during the past year; but £1629, the cost of new mains, services, meters, and prepayment stoves, has been charged direct to revenue account. The leakage or unaccounted-for gas was 3·02 per cent. The net cost of gas (1s. 1·02d. per 1000 cubic feet sold) and the return for residuals (66·85 per cent. on the cost of coal), would still compare favourably with other gas undertakings.

The work of erecting a new carburetted water-gas plant, and the remodelling of No. 2 retort-bench, have commenced.

MILITARY SERVICE ACT EXEMPTIONS.

The following notice in regard to applications for exemptions under the Military Service Act has been issued by the War Office.

An application by, or in respect of, a man to whom the Military Service Act, 1916 (Session 2) applies immediately must be made to the local tribunal of the district before June 24, if it is desired to secure his exemption from liability to military service under the Act. If a man is rightfully in possession of a certificate issued in connection with a war service badge issued by the Government, it is not ordinarily necessary to make such an application, as the badge certificate confers exemption from the Act; but if a man is in any doubt as to his position in this respect, he should make early inquiry from the local recruiting officer, producing his badge certificate for inspection.

The group system for voluntary attestation is at present open; but, as already announced, the groups will be closed on June 7, except to men who were formerly rejected on medical grounds and to lads born in 1898, who have not yet attained military age. As proclamations have been issued calling up all the voluntary groups, an application for exemption by, or in respect of, a man who now voluntarily attests, must be delivered to the local tribunal not more than ten days after the day on which the man becomes voluntarily attested.

Forms of application, showing the grounds upon which exemption from liability to military service may be granted, can be obtained from the clerk of the local tribunal of the district. In England and Wales the clerk of the local tribunal is usually to be found at the offices of the town or borough council (including metropolitan borough councils), or of the council of the urban district, or of the council of the rural district. But, in any case, information as to the proper place to ask for forms of application can be obtained at the offices of those local authorities. Applications in respect of men employed as underground or surface workers at coal mines are, in certain cases, dealt with by colliery recruiting courts, instead of by local tribunals.

Men to whom the Act applies, or who now become voluntarily attested, if they desire to put forward an application for exemption, would be well advised to make early inquiry for forms.

The City of London Corporation have received official intimation that the Board of Trade have refused the application of the Charing Cross, West End, and City Electricity Supply Company for an increase of 10 per cent. in their charges for current.

SOUTH AFRICAN LIGHTING ASSOCIATION, LIMITED.

The Ordinary General Meeting was held last Wednesday, at the London Offices, No. 90, Cannon Street, E.C., the Right Hon. Sir Daniel F. Goddard, M.P., in the chair.

The Secretary (Mr. William Cash, F.C.A.) read the notice convening the meeting.

The Late Sir Corbet Woodall.

The Chairman said, before proceeding to deal with the accounts for the year, he felt he ought to make some reference to the great loss their Company, and indeed the whole of the gas-engineering world, had sustained by the death of Sir Corbet Woodall. Those who had been shareholders for some time had known that the inception of the Company was with Sir Corbet Woodall. He paid a visit to South Africa; and, having surveyed the works, he practically bought them. He thought at the time there was a good opening for a Company—not only at Port Elizabeth, but in other towns in South Africa. Sir Corbet came home, and formed a small Company to effect the purchase; so that he was really the orginator of the Company, besides being its Consulting Engineer. The shareholders all knew him very well. He was a man who left his mark upon everybody with whom he came in contact by reason of his charming disposition, and his geniality of spirit, as well as by his great knowledge and experience of affairs. He (Sir Daniel) thought they ought to record on their transactions their regret at the great loss the Company had sustained, and their sympathy with those whom he had left behind. They were fortunate in that, in Sir Corbet's later years, he was associated with his son (Mr. Henry Woodall), who was in partnership with him, and who had now for some years taken an active part in advising the Company as to their work in South Africa. They were fortunate, he said, to have his services with them, although they had lost his father's services which could never be wholly replaced. He thought he might take it that it would be the wish of the shareholders that something should be put on the transactions of the Company speaking of the sorrow of the shareholders at the loss of Sir Corbet and expressing their sympathy with Lady Woodall and her family.

The Auditor's report was read; and it was also agreed to take as read the Directors' report and accounts.

War and the Conditions in South Africa.

The Chairman, in moving the adoption of the report and accounts, said the conditions prevailing in South Africa had not changed very materially since last year—perhaps, if anything, they were a little worse, because, of course, the war affected that Colony as it did all other parts of the British Empire. There were fewer men to employ there, more having been called up to the war. There had also been a great reduction of shipping to the South African ports; indeed, they might take it that, except for the mail boats (which were somewhat irregular now), there was no shipping. This meant that commerce and trade had diminished; and, of course, the Company suffered from this the same as everybody else. Yet, on the whole, they had done fairly well; and they must not really make any serious complaint. There had been a little falling-off in the number of consumers, and a little decrease in the average consumption, of which perhaps they ought not to disapprove in view of the constant admonitions they were receiving in the direction of economy. He had no doubt that in South Africa, it was just the same as here. Here they were advised to use 10 per cent. less coal for providing gas for lighting purposes; and he supposed that in South Africa, they were trying to economize in a like way, and this undoubtedly accounted in some degree for the smaller average consumption per consumer. The reduction was also partly due to the fact that some of the larger consumers were now using electric light; and this affected the general question. The decrease in the sale of gas was rather more than 2 million cubic feet.

Local Coal a Factor in the Financial Result.

The main feature was the coal. They had carbonized a much larger quantity of Colonial coal. Some was used in the previous year; but in 1915, they employed a larger quantity still—over 1000 tons more than in 1914. This had indeed been a great help to the Company. Of course, in some respects the coal was not so good as English coal; and it did not yield the same amount of residuals as English coal. He did not think the coke was quite so good. But it was a great deal cheaper than English coal. It was also very easily obtained; and they could rely upon more regular supplies. They were, however, in this matter much in the same position as the officer who was in command of a fort, and was called "over the coals" because he surrendered it without defending it with his guns. He said there were about twenty reasons why he did not do so; and the main one was that they had no powder. The real reason why the Company did not now use English coal was because they could not get it. The Colonial coal had been the salvation of the Company during the year. It reduced their expenses, so that they showed a larger profit with a smaller consumption of gas than last year. The other residuals had been affected a little. Ammonia had improved. There had been a smaller make of tar owing to the reduced quantity of coal carbonized; but it had been sold at a higher price. Coke was a little lower. It might be satisfactory to the proprietors to know that all the stocks they held had been written-down very considerably; so that they were putting themselves in a good financial condition.

Position at Grahamstown and other Matters.

In regard to Grahamstown, there had been a slight decrease in the consumption of gas there. There had been a serious drought; and it had affected the industries all round Grahamstown. Consequently, people had had to go away, and had had to send their cattle away. This had affected the trading conditions in the town. There had, however, only been a slight decrease in the consumption of gas; but he might say that, for the first four months of this year, they had recovered that, and there was now an increase. It would be remembered that it was previously reported that in Grahamstown, they were putting up a new holder. This had been successfully erected, was now in use, and was an

immense advantage to the Company. They had also put down a new washer; so that they would now be able to clear the gas entirely of ammonia. He was not quite sure how they dealt with the ammonia; but perhaps Mr. Woodall would be able to say. They had also put in further pumps; and, indeed, the whole of the works were now in very good condition. The economies they had effected in the working expenses were, as he had said, chiefly due to the reduction in the price of coal; and the ordinary working costs had also been reduced. There was another matter. As they could not get men to do the work, they had been obliged to employ women; and, so far, they were doing the work exceedingly well, and were giving satisfaction. The profit over the previous year had been increased by £1136. If the Directors had wished to do it, they could have advanced the dividends; but in view of the difficulties ahead, and because they could not see their way "out of the wood" yet, they thought it wise not to raise the dividend, but to keep it at the same figure as in the previous year.

Mr. JAMES MACALISTER seconded the motion.

Mr. HENRY WOODALL (the Company's Consulting Engineer) said, in regard to ammonia, at Grahamstown there was no sale for it, and the quantity made there was so small that it would not pay to put up a concentrating plant. Therefore he was afraid that the only thing to be done with the ammonia was to run it to waste. They had tried to sell it to the farmers; but they would not take it.

The CHAIRMAN said the reason they were not making sulphate of ammonia at Port Elizabeth was because they could not get the acid. They therefore made concentrated ammonia, which was sold in bottles for cleansing purposes. Replying to a question, he said that the unaccounted-for gas was rather more than last year, when it was about 12 per cent. Of course the longer the mileage of main, the more the unaccounted-for gas. So that there was a little justification for the contention of their Manager.

The CHAIRMAN, in putting the motion, said there was one observation as to the reserve fund investments. They had been written-down very well indeed; so that they were not now much above the present market value.

The motion was unanimously carried.

The CHAIRMAN proposed the payment of a dividend of 8 per cent. for the year, subject to income-tax of 2s. 8d. in the pound, and less the interim dividend already paid. He explained that a 3 per cent. interim dividend was paid last October, which left 5 per cent. more to be paid—the same dividend as was paid for 1914.

Mr. HENRY WOODALL (Llandudno) seconded the motion, which was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. HENRY BAILEY, Mr. James Macalister was re-elected to his seat at the Board. The Chairman remarked that the long experience of Mr. Macalister of South Africa and its affairs made him an invaluable colleague.

On the motion of Mr. A. J. KINGDON, seconded by Mr. F. R. SMITH, the Auditor (Mr. F. D. Griffiths, F.C.A.) was reappointed.

Mr. G. CRISPE WHITELEY proposed a vote of thanks to all connected with the working of the Company from Sir Daniel Goddard down to the latest boy appointed on the works. The shareholders were very grateful to them all—to Chairman, Directors, officers, staff, and employees—for the way the work had been carried on. Anxious and troublesome as were the times, there were signs that the work had been carefully done. They were evidently biding their time; and the shareholders hoped that the day was not far distant when the slight decreases in consumption would be reversed, and the Company would get back to the old conditions of increases and greater prosperity. That they were as prosperous as they could be in the circumstances, he had no doubt judging from the accounts.

Mr. HENRY BAILEY seconded the motion, which was agreed to.

The CHAIRMAN expressed the appreciation of all included in the resolution.

TRIBUNALS AND EXEMPTION APPLICATIONS.

At a sitting of the City Tribunal, the Salisbury Gas Company appealed for 24 employees, all married, though two were regarded as single for the purposes of the Military Service Act. All the men except one were engaged within the works; and the Manager (Mr. W. Fielden) said they were absolutely essential. Previously the Company had done their utmost to encourage enlistment; but they had statutory obligations to fulfil. The number of men employed in the June before the outbreak of war was 87; and to-day the staff numbered only 67. The quantity of gas used had considerably increased, despite the lighting restrictions. The Military Representative said the authorities realized that the Company had been very patriotic, and also that the men were engaged in certified occupations. The only thing they asked for was the release of the two youngest men appealed for, each 21 years of age. In all except these cases, exemptions were granted until Dec. 1.

The Manager of the Scarborough Gas Company (Mr. A. P. Allan) applied for exemption for a fitter and inspector, who he said was indispensable. Mr. Allan stated that the Company had lost so many skilled men through enlistment that, if they were to carry on the gas supply of Scarborough with efficiency and safety, they could not afford to lose any more. In this particular department, out of 20 men 11 had enlisted. Altogether, 33 men had joined the forces; and of the 106 men left, 98 were ineligible or badged. The Tribunal decided that there was no case for exemption from the employers' standpoint. On the grounds of personal hardship, the applicant was granted temporary exemption for three months.

At a sitting of the Devon Appeal Tribunal at Exeter, the Manager of the Exmouth Gas Company (Mr. W. E. Dean) appeared in support of an appeal of two of his employees engaged in the district visiting consumers' houses and attending to the mains. There were, he said, nine men of this class before the war; and now there were four, including one who was about to join, and for whom the Company were not appealing. The two men appealed for were indispensable to the proper working of the business. He had made attempts to obtain the services of men over military age or medically unfit, but had not succeeded. The Chairman said the local tribunal, with a knowledge of the facts, were of opinion that these men could be spared; and the Appeal Tribunal did not feel inclined to reverse this decision. Mr. Thomas (for the Company) said the Company were under statutory powers to supply gas; and their customers might bring an action against them for failing to do so. The Chairman replied that the Tribunal had nothing to do with that. Mr. Dean asked that the men might have temporary exemption; but the Military Representative opposed, and the application was refused. In the case of a labourer in the Company's employ, the appeal was also dismissed.

Mr. C. V. Bennett, the Manager of the Herne Bay Gas and Electricity Company, appealed to the local Military Tribunal for the exemption, on grounds of indispensability, of two married and attested employees. He said that for the sake of conciseness, the men were termed "gas-fitters;" but their proper description was "gas-works fitters." Their primary duty was to keep in repair works and plant, both manufacturing and distributing. The distribution plant, which was that outside the actual manufacturing works, he contended, was part of the works. Among the things which the men had to do was to examine the mains, services, meters, and stoves from time to time—more particularly the mains. It was true that the Company wedged-in among the duties of these men attention to consumers' private fittings; but this was a negligible quantity. Both for the efficiency of their own operations and the protection of the public, the Company should be well equipped with the services of gas-works fitters. The number of these fitters in the Company's employ was already 25 per cent. less than was needed. The Company had encouraged enlistment from the very first, and had lost over 44 per cent. of their men; and they were paying half wages to those who had gone, and who wished to come back. Men inside the Company's works were engaged in an exempted occupation; but, as he had proved, the Company's work really continued almost to the point of ignition—at any rate, to the outlet of the meter. Therefore these two employees were engaged in the Company's works, and came under the category of an exempted occupation. The Chairman said they admitted Mr. Bennett made out a strong case, and the Tribunal would grant exemption until Sept. 30, conditional on the men continuing in this work. Mr. Bennett would then be at liberty to apply again.

DAYLIGHT SAVING AND GAS CONSUMPTION.

After a week of experience in connection with daylight saving, there were a number of reports regarding the effect of the "new time" on demands for artificial illumination.

Alderman Kay, the Chairman of the Manchester Corporation Gas Committee, in the course of an interview, said it had been found that the change will make a difference of about 600,000 cubic feet in the consumption of gas for lighting during the 24 hours. In other words, the result of the new Act will be a reduction in gas consumption for purposes of illumination of between 4 and 5 per cent. Last Wednesday, the "Manchester Guardian" said: Daylight saving is having a marked effect on gas consumption in Manchester. So far it is estimated to mean a lessened consumption to the extent of 800,000 cubic feet, or a reduction of £100 a day in the revenue of the Gas Department. That is the result of a comparison of the consumption since Sunday, May 21, with the amount consumed at this period of the year in normal times. The Gas Committee are concerned as to their finances, and as to how they are to find the £50,000 which they are expected to contribute this year in aid of the rates. They have, they say, exhausted their reserves—which three years ago amounted to £70,000. The alternatives before them are to increase the price of gas or lower the sum given in aid of the rates.

The Directors of the Stirling Gas Company have resolved to increase the price of gas from 3s. 2d. to 3s. 4d. per 1000 cubic feet as from May 15, owing to the increased cost of materials and charges and the effects of the Summer Time Act. A year ago the price was increased from 2s. 6d. to 3s. 2d. per 1000 cubic feet.

During the week the saving of gas in Bradford included that due to the fact that no street gas-lamps were lighted. Under the restricted street-lighting arrangements, about 3600 lamps were retained; but even these are now dispensed with. As a matter of fact, in comparison with the corresponding week of last year, there was an increase in the consumption of gas in Bradford to the extent of about 11 per cent.; but this is accounted for by the circumstance that the comparison is with Whit-week of last year, when, owing to the holidays, less gas than usual was consumed.

Experience of the new summer time seems to indicate that it will be a good thing for Leeds tramways, but bad for the gas undertaking unless much more use is made of gas-cookers.

Some idea of the economy which will be effected in the consumption of coal at Dewsbury may be gleaned from the fact that throughout the summer 1755 public gas-lamps and 33 electric lamps will be extinguished an hour earlier each night. During June no street-lamps will be lighted at all, as the hour for lighting-up would be 10 o'clock, and that for extinction 11 o'clock. For the same reason the Batley Corporation immediately decided to suspend street lighting until further notice.

So far there has been little, if any, variation in the consumption of gas and electricity at Keighley. The Gas Engineer (Mr. W. Baillie) stated to a representative of the "Yorkshire Observer" that there were so many causes at work in regard to gas consumption that it was practically impossible to tell whether the week had shown a decreased consumption purely on lighting account. He did not, however, think there had been any decrease through this cause alone. Public street lighting has now ceased.

There has been a considerable reduction in the consumption of gas for lighting at Halifax. During the first four days of the new Act, the drop in the amount sent out from the gas-works was something like 7 per cent. below that sent out during the corresponding Sunday, Monday, Tuesday, and Wednesday of 1914. The same days in 1915 clashed with the Whitsuntide holidays; and naturally, with a greatly reduced consumption at this time, no fair comparison could be made. The days in 1914 can, however, be taken as a good average for this

time of the year; and how the output has varied can be gathered from the following figures:

	1914. Cubic Feet.		1916. Cubic Feet.
Sunday-Monday	1,285,000	..	1,064,000
Monday-Tuesday	2,269,000	..	2,073,000
Tuesday-Wednesday	1,960,000	..	1,765,000
Wednesday-Thursday . . .	1,832,000	..	1,655,000

This shows a total reduction for the four days of 789,000 cubic feet. It must be remembered, however, that in 1914 the public street-lamps were burning; and as at present these are not in use, the total saving for domestic consumption must be reduced. There are some 4800 public lamps under the control of the Gas Department; and assuming that these consume on an average 75,000 cubic feet a night, it will mean reducing the total by 300,000 cubic feet. But even so, the saving on the four days for domestic use works out at 7 per cent. It is pointed out that a further saving could be effected if consumers would see to it that their burners and fittings are in good order.

Referring to the matter, the "Halifax Guardian" says: While the Board of Trade are urging corporations to save gas used for lighting purposes, the Ministry of Munitions are calling upon gas authorities to maintain the supply of those valuable bye-products (used in the making of high explosives) which are derived from gas manufacture. At first glance, this would appear altogether absurd; but gone into thoroughly, the wisdom of the two demands is apparent. Only in one way can householders assure both appeals being met. More gas and less coal must be used for cooking purposes. Economy in coal is the great need. This can be effected by the use of gas for cooking purposes; and the coal which will be treated at the gas-works will supply consumers with the heat required, and at the same time provide the Ministry of Munitions with the necessary bye-products. Thus will the common object of the Board of Trade and the Ministry of Munitions to economize coal in every possible way be realized.

In the case of Liverpool and the neighbourhood, estimates of the actual saving on the domestic lighting bills vary from 1 to 5 per cent. among the gas and electric experts; while a leading house agent of the city places the economy effected in an average cottage rented at 5s. 6d. weekly as high as 6d. per day in coal, gas, and paraffin oil. He remarks that fires are lighted later and extinguished earlier, and that the gas-ring suffices for early breakfast. So far as the Gas Company are concerned, it is said that, owing to the scarcity of coal and oil, gas stoves and geysers are more than keeping pace with any decline of gas lighting.

Mr. John Bond, the Gas Engineer at Southport, expresses the opinion that the reduction in the quantity of gas used for lighting was about balanced by an increase in the day load of gas used for cooking purposes. This was no doubt due in a great measure to the warmth of the weather, which induced people to utilize gas for cooking in preference to coal-fires. Mr. Bond does not think that, on the year's consumption, the new Act will cause more than a 2 per cent. reduction; and this will make no difference in the amount—£6000—promised by the Gas Committee out of profits in relief of the current year's rates. The Corporation Electrical Engineer (Mr. Black) states that, in comparison with the preceding week, the first seven days of the Summer Time Act showed a decreased consumption of electricity to the extent of about 20 per cent. Practically all this reduction meant a saving to the private consumer.

The opinion in official circles in Wallasey is that the primary object of the Government—to save 10 per cent. of the coal consumption of the country—will not be achieved. In the first week of daylight saving, the total gas consumption in the borough was 11,200,000 cubic feet; during the previous week it was 11,400,000 cubic feet; and in the corresponding week of last year it was 11,800,000 cubic feet. There was a 12 per cent. decrease in the consumption of electricity compared with the previous week; but it is pointed out that this saving cuts both ways, inasmuch as there will be reduced profits for the electricity undertaking, and therefore less to go towards the relief of the rates.

In an interview at the beginning of last week with a representative of the "South Wales Daily News," Mr. George Clarry, the General Manager of the Cardiff Gas Company, said it was too soon yet to give any figures or to arrive at any definite conclusions; but, so far as he could see at present, it would have scarcely any effect at all. The effects might be greater later on, when the days began to draw in; but at present most of the shops closed about 7 o'clock, and the extra hours of daylight did not save them anything in the burning of gas. So far as private houses were concerned, a great many people had not yet become accustomed to going to bed earlier than they did before, and still burned gas.

Mr. F. P. Tarratt, the Engineer of the Darlington Corporation Gas-Works, said, in an interview on the subject of the saving effected by the Summer Time Act, that so far the measures had made no appreciable difference. He did not think it would make much difference in manufacturing towns like Darlington, where gas was regularly and extensively used in local industries. So adaptable was human nature, that people had forgotten that the town used to be well lighted until after 11 o'clock at night, and that main thoroughfares and many streets were under reduced lighting until the small hours. The result of the extra daylight could not be fully measured for this reason also.

Mr. Matt. Dunn, the Engineer of the Stockton-on-Tees Corporation Gas-Works, questioned on the same subject, said that, so far as the gas output at the works was concerned, there had actually been an increase of 5 per cent.; while in the general order of things there must have been less gas used as an illuminant since the Act came into operation, the increased output was due to the greater use of gas-cookers, which were decidedly more economical than the burning of high-priced coal. They had been told, he said, by the Board of Trade that the use of coal must be restricted; while, on the other hand, the Ministry of Munitions had informed them that there must be an increased output of gas, as it furnished such valuable chemicals as benzol and toluol. Remembering this, and also the public demand for the use of gas and

DAYLIGHT SAVING

WILL MEAN LESS GAS CONSUMED FOR LIGHTING.

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SUPPLIED TO YOUR CONSUMERS WILL ENCOURAGE THEM TO USE GAS FOR COOKING AND HEATING, AND WILL

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coke as a fuel, Mr. Dunn claimed that, by increasing the sale of gas, actual economy would be effected, because it diminished the public demands on the coal output.

Middlesbrough is in the happy position of being able to save a large sum per annum by utilizing the coke-oven gas from the works of Messrs. Samuelson; and the consumption of coal is negligible. Little difference has so far been felt in connection with the Summer Time Act. There are many large works in the borough which are continuously engaged; and, of course, there is no saving in regard to these. Again, there has lately been a big increase in the quantity of gas consumed for cooking purposes.

Information from a company who supply a large part of Cleveland shows that gas consumption was slightly higher in the month just passed than in the corresponding month last year. This is thought to be to some extent due to the fact that householders have taken ample precautions against the rigorous lighting restrictions, and are not now loth to enjoy the best light possible.

How the Birmingham Gas Department will be affected during the 133 days of summer lighting cannot, says the "Post," be estimated until the quarterly returns are prepared. So far, the altered conditions do not seem to have made much impression. As a matter of fact, the output of gas has gone on steadily increasing; and even on the day the Act came into operation, there was an advance instead of an expected decrease. The output on the Sunday naturally is regulated by the demand for gas for domestic purposes. Now that coal is so dear, gas has largely taken the place of the coal-fire for the cooking of the household meals, and the maximum pressure on the resources of the department is realized between 12 and 1 o'clock—this being the time, generally speaking, for the preparation of the Sunday dinner. The clock was advanced an hour on the morning of the 21st; but instead of the maximum pressure occurring between 12 and 1, it was between 1 and 2 o'clock—thus suggesting that the housewives as a rule had adhered to the old familiar time, instead of adopting the new summer time. Curiously, too, the consumption of gas on that Sunday established a record, and not a reduction. Between the hours of 11 and 2 o'clock—the hours when the principal domestic consumption takes place—the output of gas amounted to 6,077,000 cubic feet, as compared with a normal quantity of about 5,000,000 cubic feet, and a maximum of 5,396,000 feet on the Sunday before the Daylight Saving Act was in force, and which up to that time was the record consumption for the three hours. The department has not been able to separate the consumption of gas for domestic purposes from that for industrial purposes for the short period which has elapsed since the Act came into operation.

On account of the lack of coal, the Danish Government have issued an order making drastic restrictions regarding the use of gas, electric light, and oil, especially in respect to shops, restaurants, and streets. In each case, only lamps of a certain power are allowed.

THE WASHING-OUT OF NITRATE FROM ARABLE SOIL DURING LAST WINTER.

By E. J. Russell, D.Sc., and A. Appleyard, M.Sc., of the Rothamsted Experimental Station, Harpenden, Herts.

[From the April issue of the "Journal of the Board of Agriculture."]

The past winter has been much wetter than usual, and during the whole period, October to February, there was a considerable amount of rain-water percolating through the soil. The quantities are always fairly high, but were exceptionally high in December and February.

It is well known that, in washing through the soil, water carries with it a considerable amount of soluble material. Two important effects are produced: (1) Some of the clay (the finest material in the soil) changes from the desirable crumbly state into an undesirable sticky condition, or, in the language of the chemist, it becomes deflocculated. (2) Some of the nitrate (the extremely valuable plant nutrient) is washed out and lost from the land. The change in the state of the clay is obvious to anyone walking over heavy land. The loss of nitrate is not so obvious; but it is more serious to the farmer. It is least on heavy land, and greatest on good land and on light land; but it mounts highest on land that was well done last year and either fallowed or bastard-fallowed—these being the conditions under which the maximum amount of nitrate production goes on in the soil.

The result of the rainfall last winter, therefore, was that on a specified plot, which had been well done and fallowed last year, and brought into high condition, a loss was experienced of 120 lbs. of nitrogen, equal to 7 cwt. of nitrate of soda per acre, which at present prices is worth a good deal.

Fortunately all the ground did not lose so heavily. The cropped plot was never able to accumulate nitrate to anything like the extent of the fallow plot, partly because the organisms made less, and partly because the crop took up much of what was there. No more than 90 lbs. per acre is ever shown in the analysis; but the fact that this amount was maintained in spite of the October and November percolation indicates that more had been produced but was washed away. Even as it is, a loss of 40 lbs. of nitrogen is recorded—equivalent to more than 250 lbs. of nitrate of soda, and as much as is contained in 24 bushels of wheat and the corresponding amount of straw. In the end, however, the soil begins the new season just as well provided with nitrate as last year's fallow.

Taking the Harpenden results as a whole, they show that the fields which had not been unusually well done lost some 30 lbs. of nitrogen per acre, equivalent to 190 lbs. of nitrate of soda, as a result of the winter rainfall, while the plots that had been well done lost considerably more.

The object of the experiment carried out was to find out how much

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nitrogen had been lost. The question naturally arises, however, Could the loss of nitrate have been avoided? Other experiments show that some of it could, especially the very heavy loss on the fallow plot. Had mustard or some quick-growing crop been sown in September when the soil was, so to speak, at the top of its form, the nitrate would have been taken up by the plant and held safe against washing by the rain. Then, if the mustard had been ploughed-in or fed to sheep on the land, the nitrogen would have been returned to the soil—not, indeed, in so available a form as nitrate, but still in a form that would easily change to nitrate in spring and would in the meantime be safe from loss.

The obvious lesson is that land which has been got into a good state in autumn should at once be sown with either the crop it is intended to carry or a catch crop.

The Remedies.

It is useless now to say what ought to have been done in the autumn; we have to find remedies which will be valid at present. Two bad effects of high winter rainfall have to be met:

(1) The effect on the clay, which shows itself in the bad state of the surface.

(2) The depletion of the stock of soil nitrates.

The clay has to be flocculated once more; and this can be done by a variety of agents—including chalk, limestone, lime, or soot. There is hardly time for chalk to act; and it is not certain that even ground limestone would work at this short notice. The choice is, therefore, reduced to lime or soot.

The loss of nitrate has to be made good. This can be done by a dressing of quick-acting nitrogenous manure—nitrate of soda, nitrate of lime, sulphate of ammonia, soot, or nitrolim.

It will be noticed that soot serves both purposes and is, therefore, well adapted for spring dressings—a fact that the practical man has long since recognized. There is reason to suppose that both nitrolim and nitrate of lime would improve the tilth, though longer experience is necessary before expressing too definite an opinion. On the other hand, nitrate of soda does not improve the tilth, but may in heavy soils make matters worse. Later on, however, when the land is drier, this difficulty largely disappears; and it so happens that nitrate of soda can be put on later than any of the other manures that have been mentioned here.

Apart from the question of tilth, the choice between these quick-acting manures is at present largely one of convenience; there being still time for any of them to act. In a short time the choice will be narrowed down. The important thing, however, is that the nitrate supplies have been depleted by the winter rain, and must be replenished unless this has already been done. Even in peace time the need of spring dressings would be great this year, and in present circumstances it is especially so. There are difficulties of transport and delivery of quick-acting manures, but it may be hoped that these will not prevent proper treatment of the crop.

TAR FOR ROAD PURPOSES.

Standard Nomenclature and Specification.

The Engineering Standards Committee recently issued their report [No. 76] on "Standard Nomenclature of Tars, Pitches, Bitumens, and Asphalts, and Standard Specifications for Tar and Pitch, for Road Purposes." The Sectional Committee on Road Material was appointed at a meeting of the Main Engineering Standards Committee, on July 18, 1912; and a Sub-Committee to deal with bituminous materials was appointed by the Sectional Committee on June 12, 1913, and met for the first time the following October.

The report points out that the materials now used by road engineers for binding together the stones and other mineral aggregate used to form road crusts and road surfaces may be conveniently divided into three groups. These are: (1) The tars and pitches obtained by the destructive distillation of coal or similar substances. (2) The bitumens and asphalts found in Nature, or obtained artificially from asphaltic oils. (3) Chemical binders, including portland and natural cements which owe their cementing value as road binders to chemical action, and which are not dealt with in the present report.

In this country, the first group of road binders—the coal tars and pitches—have been in use for many years; and as the Road Board in 1911 issued specifications for the tars, tar oils, and pitches which they recommended for road purposes, these materials have already to some extent been defined by those specifications. The Road Board early in 1914 issued a second edition of these specifications. Only two classes of tar, and one class of pitch were dealt with; and as these specifications are of such recent date, the Committee recommend that they be adopted provisionally as the "British Standard Specifications for Tars and Pitches used for Road Work."

The Committee consider it is desirable to make a sharp distinction between coal tar and paraffin oil derivatives on the one side, and native bituminous substances and asphaltic oil residues on the other. They do not accept the American definition of bitumen which would include coal tars.

Definitions.

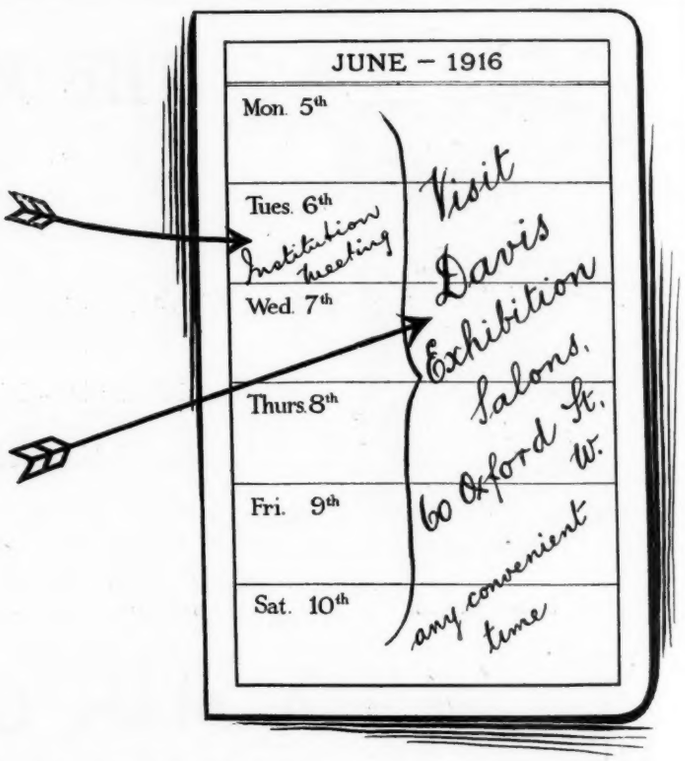
Tar.—Tar is the matter (freed from water) condensed from the volatile products of the destructive distillation of hydrocarbon matter, whether this be contained in coal, wood, peat, oil, &c. A prefix such as "Coal," "Wood," "Peat," "Gas-Works," "Blast-Furnace," "Coke-Oven," &c., must be added to the word "Tar" to indicate the source of origin or method of production.

Pitch.—Pitch is the solid or semi-solid residue from the partial evaporation of tar.

Bitumen.—Bitumen is a generic term for a group of hydrocarbon products soluble in carbon disulphide, which either occur in Nature or

Institution Meeting.

Two important entries for the Engagement Diary of every Member of the Institution of Gas Engineers.



Responsible Officials of The Davis Gas Stove Co., Ltd., will be in attendance at The Exhibition Salons, 60, Oxford St., throughout the week to receive Visitors.

are obtained by the evaporation of asphaltic oils. The term shall not include residues from paraffin oils or coal-tar products. Commercial materials may be described as bitumen if they contain not less than 98 per cent. of pure bitumen as defined above.

Native Bitumen.—Native bitumen is bitumen found in Nature, carrying in suspension a variable proportion of mineral matter. The term "native bitumen" shall not be applied to the residuals from the distillation of asphaltic oils.

Asphalt.—Asphalt is a road material consisting of a mixture of bitumen and finely-graded mineral matter. The mineral matter may range from an impalpable powder up to material of such a size as will pass through a sieve having square holes of ¼ inch size.

Native or Rock Asphalt.—Native or rock asphalt is a rock which has been impregnated by Nature with bitumen.

The Committee recommend that for convenience of identification prefixes denoting geographically the source of origin should be attached to each of the four terms defined above.

The British standard specifications for tar for road purposes, included in the report, are based upon the Road Board Specifications Nos. 4 and 5, and are published with the approval of the Road Board. They include standard specifications for No. 1 tar and No. 2 tar, and tests for ascertaining in a quick and simple manner whether consignments of tar differ fundamentally from an approved sample, or whether they are of the No. 1 or No. 2 grade. The standard specification for pitch for road purposes is based upon the Road Board Specification No. 6.

TOWN GAS AS A FUEL FOR FURNACES.

Before the Engineering Society of the Finsbury Technical College, Leonard Street, City Road, last Thursday week, Mr. E. P. TAUDEVIN, the Expert Furnace Representative of the Richmond Gas Stove and Meter Company, Limited, delivered a lecture on "Town Gas as a Fuel for Furnaces." In the course of it, he illustrated on general lines the present and prospective possibilities of gas as a furnace-fuel, and showed the several types of furnace, and their wide application as a unit or units in connection with the necessary productive plant for every kind of munition of war.

Of course, he said, town gas has its limitations; but its field of useful service covers many industrial heating operations, while its present use in connection with very large annealing furnaces would almost lead one to believe that, given a reasonable cost of supply, there is practically no limit for its employment. A good many useful papers are available giving the comparative thermal value of fuels; and much has been said on this subject to justify the belief that all firing, whether it be under boilers or for furnaces of any description, should be gaseous. A ton of coal for furnace heating contains, according to quality (say), 24 million B.Th.U.; and the wastage due to direct firing and primitive furnace design in many cases amounts to 50 per cent. But though all are agreed as to the necessity for burning fuel with economy, it is his opinion that it will require legislation at some future date to give the *coup de grace* to the fuel-wasting furnace and smoky chimney. To the author's mind, one can imagine that large consumers of coal will take on gas making with the idea of using the primary products—gas and also coke—for hot producer gas—while for the other bye-products a market will be found. If large gas-making stations were established near the pit heads, in the same way as are coking plants, it seems to him that all products after carbonizing could be with great advantage distributed in the intense industrial areas; while gas, of high thermal value, could be distributed for industrial purposes upon a more satisfactory basis.

Referring to what some gas undertakings are doing in the way of coping with the increasing demand for fuel gas, the lecturer said Sheffield was perhaps the first industrial community to encourage on an extensive scale the use of town gas for the thermo-treatment of steel and other heating operations. The Sheffield United Gas Company had catered for the requirements of their consumers in no half-hearted manner. They had anticipated the value of cheap gas as a furnace-fuel; and their foresight and energetic propaganda has resulted in a very considerable proportion of their make being sold for industrial fuel purposes. Birmingham has harnessed-up gas to the extent of something like 1000 million cubic feet, excluding gas-engines. This approximate figure was published about fifteen months ago; and probably by the end of the present year the gas consumption for furnaces in the Birmingham area will approximate the huge figure of 2000 million cubic feet per annum. The smaller neighbouring town of Coventry provides a very interesting example of the utilization of fuel gas on a big scale. No less than 60 per cent. of the gas made is used by manufacturers for fuel purposes; and this surprising figure does not include that employed for motive power. In London, much has already been accomplished on the same lines—many works using gas-furnaces on a very extensive scale. One firm employs, exclusively on the production of war materials, something like 150 different types of furnaces, consuming about 300,000 cubic feet of gas a day.

In the second portion of his lecture, Mr. Taudevin reviewed some typical gas-furnaces, remarking on their general design and application. He described and illustrated by lantern slides: (1) Natural draught regenerative furnaces, which may be in the great majority of cases used for temperatures up to 800° C. or thereabouts, and in some instances above this. (2) Furnaces with gas at normal city pressure and fan draught, suitable for temperatures between 800° and 1400° C. (3) Low-pressure gas and air-blast or high-pressure gas, for small furnaces where high working temperatures are required in a restricted furnace-chamber. Under the second heading, he explained that a new method of heating furnaces—known as the "L.P.G.A." system—was patented by Richmond's about three years ago. The principles involved have

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been successfully applied to oven-furnaces, as well as to forging and metal melting. From the point of view of economy in gas consumption, it was mentioned that steel has recently been annealed in a "L.P.G.A." furnace, capable of taking 8 or 9 tons, with a consumption of 3000 cubic per ton, when 6 tons were being treated per charge, and the reheating of billets for rolling at the rate of under 3500 cubic feet per ton—the material being heated to over 1100° C. In a furnace with walls of suitable thickness for such high-temperature work, this consumption should be considerably reduced.

The following are figures for annealing steel from actual commercial working results in Sheffield:

	"L.P.G.A." Richmond Oven-Furnace.
Weight of charge	6 tons
Total time of heating	3 hours
,, ,, cooling	45 ,,
,, ,, operation	48 ,,
Maximum temperature attained	850° C.
Gas consumption per ton of steel annealed	3000 feet
Cost of gas ,, ,, ,,	3s.

Steel annealed in the "L.P.G.A. furnace, added the lecturer, is free from scale, and the annealing is, if anything, more uniform. This, in addition to the time and space saved, and the omission of the packing-boxes, proves the superiority and economy of town gas for this purpose.

NOTES FROM SCOTLAND.

Edinburgh and Leith Gas Commissioner Enlists.—At the last meeting of the Edinburgh and Leith Gas Commissioners, a letter was read from Judge Harvey (a Magistrate, and one of the representatives of the Leith Town Council on the Gas Commission), intimating that he had enlisted in the 10th Seaforth Highlanders, and would therefore be unable to attend the meetings for some time to come. A few days after enlistment, Mr. Harvey was made Lance-Corporal.

Sulphate of Ammonia Exports.—Addressing the shareholders at the annual meeting of the Pumpherston Oil Company, Mr. Thomson M'Lintock, referring to sulphate of ammonia, said the principal outlet for this product was the export market; but in consequence of the shortage of nitrate of soda, and the desire to increase the crops of the country, the Board of Agriculture decided to suspend exports for a period. The makers of sulphate of ammonia, being anxious to co-operate with the Board of Agriculture, offered to reserve any quantity that might be wanted for home use at a fixed price, and, at the same time, pointed out that, as the home demand could not possibly take up the whole of the country's production, to prevent stocks from becoming unwieldy, export licences should be granted periodically for any quantity that might accumulate in excess of the home demands. This course, however, was not acceptable to the Board of Agriculture, with the result that makers' works became congested with huge stocks, causing much inconvenience to the producers; while at the same time a strong export demand was ruling which could not be taken advantage of, because no export licences were being granted. It was to be hoped that, should the Board of Agriculture find it necessary to make any further arrangements of this kind, they would take the manufacturers with them, and thus obviate the creation of many difficulties for the producers as well as the unnecessary loss to the country consequent on any stoppage of export of such a valuable article as sulphate of ammonia.

Asphyxiation of a Gas Worker.—An interesting question was raised in the Sheriff Court at Airdrie last Friday in an inquiry that was being held into the circumstances of the death of Donald M'Lellan, a gas stoker at the works of the Holytown Gas Company. Giving evidence before Sheriff Lee and a Jury, David Smith, formerly employed in the works as a stoker, said he happened to call at the works on Sunday, March 5. On entering, he noticed a very strong smell of gas, and thinking it came from the engine-room he went there and found M'Lellan lying on the ground near to a valve from which gas seemed to be escaping. He found the man was unconscious, and pulled him towards the door. He then ran and told the Manager and a doctor; and although every means was taken by artificial respiration to bring the man round, he was pronounced by the doctor to be dead from gas poisoning. Mr. James M'Nair, the Manager, said the bye-pass valve in question had been stiff, and he had told M'Lellan that it would require to be seen to. He did not, however, intend the man to interfere with the valve till he was himself ready; but during his absence that afternoon M'Lellan had, while on duty by himself, attempted to put it right, and been overpowered by the escaping gas. A juryman inquired whether there were any means in readiness in the gas-works to counteract the gassing of a man, and was informed that one of the workmen was a mines rescue man, but he was not on duty at the time. The Manager, recalled, stated that there were no appliances in the works for restoring animation in a case of gas poisoning. The Inspector had suggested that the artificial respirators should be used; but they never had them in such works. Another juryman asked whether they ought not to keep oxygen in a gas-works for cases of this kind. The Sheriff: No; it seems there is no provision of the kind. Eventually, the Jury returned a formal verdict in accordance with the medical evidence, and made no recommendation.

Three Children Suffocated by Gas.—At an inquest at Hull on the bodies of three young children, the mother stated that she put them to bed and went out. Returning later, she noticed a smell of gas, and going into the room found the children unconscious in bed. The room was full of gas; and a piece of the pipe leading to the bracket was lying on the floor. The Coroner said there was no doubt the children in playing about had broken this pipe, which was fixed outside the wall. A verdict of "Accidental suffocation" was returned.

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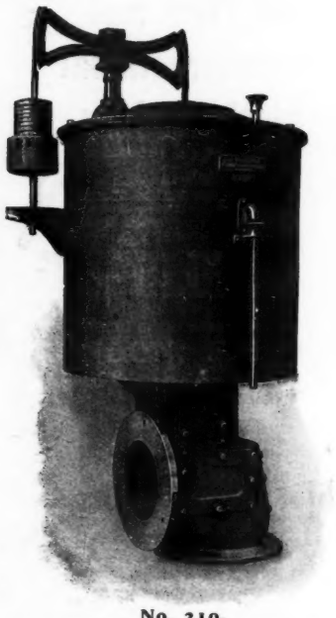

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *June* 5.

There is no change to report in the London market for tar products. Creosote continues steady at 4d. to 4½d. per gallon, and pitch is still 19s. 6d. per ton, in bulk, at sellers' works. Solvent naphtha, 90-160°, is spoken of at 2s. to 2s. 1d., naked, makers' works.

Business in sulphate of ammonia remains quiet, but there is a good inquiry for forward delivery at a slight premium.

Tar Products in the Provinces.

June 5.

The markets for tar products remain the same. There is nothing fresh to report concerning pitch. Business is still very quiet in creosote. There appears to be little solvent naphtha offering. Heavy naphtha is in fair demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 15s. 6d. to 19s. 6d. Pitch, East Coast, 15s. to 15s. 6d. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6¾d. to 7d. Solvent naphtha, naked, North, 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2½d. to 2¾d. Heavy oils, in bulk, 3¾d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *June* 3.

The market for this material has remained fairly steady throughout the week, but there has not been so much keenness shown in purchasing as there was last week. Export licences have been given out freely, but, in consequence of the shortage of freight room, it is only possible to make up arrears of shipments slowly. The closing quotations are £16 17s. 6d. per ton f.o.b. Hull, £17 f.o.b. Liverpool, and £17 2s. 6d. f.o.b. Leith, for June delivery. For July-December delivery, manufacturers now ask £17 10s. per ton at the best ports; but this price has not been reported as paid, although it has transpired that £17 7s. 6d. f.o.b. Liverpool has been realized.

Nitrate of Soda.

There is no change in this market, and quotations are repeated at 18s. 7½d. per cwt. for ordinary, and 19s. 3d. for refined quality, on spot.

Sulphate of Ammonia.

From another source it is reported that, although prices remain the same, business is very difficult at the present moment. Outside London makes are quoted at £15 12s. 6d. to £15 15s.; Hull, £16 10s. to £16 12s. 6d.; Liverpool, £16 12s. 6d. to £16 15s.; Leith, £16 15s. to £16 17s. 6d.; Middlesbrough, £16 12s. 6d. to £16 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade in the north-east is changed by the limitation scheme for the exports to France. It is true that it has only partially been brought into operation; and it will be some days before it works smoothly. It really provides two classes of prices for coal—one for the fuel to be sent to France, and another range of values for neutral countries, such as Sweden and Norway. In the steam coal trade, as much as 60s. to 61s. 6d. per ton f.o.b. was quoted for best Northumbrian steams for neutral countries; 57s. for second-class steams; and 32s. 6d. for steam smalls; while there are as yet few sales at the arranged "limited" prices for France. But there is not much free for delivery for a week or two—the scheme not affecting previously-made contracts. Production seems fairly good; and the holidays usual at Whitsuntide will be postponed this year. In the gas coal trade, the demand is full. For best Durham gas coal, the general price is 37s. 6d. per ton f.o.b.; for second-class coal, about 35s. 6d.; and for "Wear Specials," 37s. 6d. to 38s. 6d. per ton. For the arranged sales to France, buyers of fuel are waiting to see what effect the new conditions will have on the market. There are some sellers who believe that requisitions for coal for France will be very heavy, and that coal for neutral countries will maintain high values; but with very little free coal, such sales will not probably be large for a little time to come. The freight market is easier—gas coal, Tyne to Rouen, having now a limitation freight of 27s. 6d. Coasting freights also show occasional ease. In the coke market, the demand is steady generally, and for export it is heavy. Good gas coke is 27s. to 28s. per ton f.o.b in the Tyne.

Gas-Poisoning at Belfast.—A Coroner's Jury at Belfast found that James Scott, of 20, Lowther Street, who was found dead in bed, had suffered from the effects of gas-poisoning, which was caused by a hole made in the inlet pipe allowing gas to escape freely. There was no evidence to show how, or by whom, the hole was made.

The Help of the Gas Industry.—Addressing a meeting in Sheffield last week, Dr. Addison, the Parliamentary Secretary to the Ministry of Munitions, remarked that the amount of coal-tar bye-products now obtained from gas-works, coke-ovens, and other modern plants was beyond any comparison with what was formerly produced. If the science and organization which were necessary to make a full use of these in their dyeing and other industries after the war were not forthcoming, it would be thoroughly discreditable to them.

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Light and Power for War Purposes.

The following addition, dealing with the supply of light and power for war purposes, has been made to the Defence of the Realm Acts: Any company, authority, or person supplying or authorized to supply water, light, heat, or power, shall, if so required by the Admiralty or Army Council or the Ministry of Munitions, supply water, light, heat, or power to any factory, building, camp, or other premises belonging to, or used for the purposes of, the Admiralty or Army Council or the Minister of Munitions, and shall carry out such works and render such services as may be directed by the Admiralty or Army Council or the Minister of Munitions for the purpose of enabling such a supply to be given either by themselves or by some other such company, authority, or person: Provided that a company, authority, or person shall not be required under this regulation to supply water, light, heat, or power to premises within the area of supply of any other company, authority, or person except with the concurrence of the appropriate Government Department; and if any question arises as to which Government Department is the appropriate Government Department, the question shall be finally determined by the Treasury. If any company, authority, or person fail to comply with a requisition under this regulation, the company, authority, or person shall be guilty of an offence against these regulations; and any director or officer of the company or officer of the authority who is knowingly a party to the default, shall also be guilty of an offence against these regulations.

Meter-Rentals at Nottingham.—There has been no aspect in regard to which the policy of the Nottingham Corporation Gas Committee has met with more stringent criticism of late years than in relation to the perpetuation of meter-rents. Last year, according to the accounts, the rentals represented £6843 to the local exchequer; and the contention in favour of a remission of the charge finds favour from members of the Council, who have urged that in large numbers of cases of customers of old standing the original cost of the meters has been more than defrayed. Whatever may be the equity of the consideration, however, the prospect of a change, under present conditions, appears remote.

Ilkeston Municipal Undertakings.—The Ilkeston Corporation are fortunate in their gas undertaking, which has proved a valuable municipal asset; but both the tramways and electricity concerns have been for many years veritable "white elephants"—£2500 annually having been lost upon the former, while the latter has entailed also a considerable burden on the rates. No surprise is felt locally, therefore, at the circumstance that the General Purposes Committee have recommended the disposal of both these branches of unprofitable municipal venture to a company owning rights in analagous concerns in the district. The proposal is to come up for confirmation at a meeting of the Town Council this week; and there appears little doubt of its acceptance—having regard to the welcome relief it will afford.

Gas-Workers' Wages at Sheffield.

On Sunday evening of last week, there was a mass meeting of Sheffield members of the Gas-Workers' Union to discuss the question of wages which had been placed before the Directors of the Sheffield Gas Company. Mr. C. H. Blackburn (Sheffield District Secretary) gave a detailed statement of the position, from which it appeared that an application was made to the Company on April 15 for an advance in wages of 3s. a week to the women workers now engaged at the various gas plants. Further, the men asked for an all-round increase of 1s. in their wages, to bring them into line with the general conditions prevailing in the city—namely, 4s. war allowance. Other minor points relative to the conditions of the women's work were also alluded to. The reply from the Gas Company was to the effect that they could not see their way to grant the 3s. increase to the women workers. It was stated that the women at present are engaged at the rate of £1 per week of 53 hours; and one of the points raised by the Company was that the women are not doing the same amount of work that the men did previously. With regard to the 1s. per week special allowance for the men, the Company maintained that they were being paid a higher rate of wages than that generally prevailing in the city for the same class of men. In the circumstances, they did not feel disposed to make any further concessions. A resolution was unanimously passed that the District Secretary should press the Company for an interview to discuss the matters in dispute. Failing the granting of an interview, it was decided to bring the matter to arbitration.

Opposition to the Yeadon Water Bill.—At a meeting of the Wharfedale Rural District Council, it was decided to oppose the Yeadon Water Bill in the House of Commons. Under the Bill, the Yeadon Water Company are seeking parliamentary sanction for additional works (including power to obtain more water), an extension of the limits of supply, and additional capital. The Bill has, as reported in the "JOURNAL," already been before a House of Lords Committee, when opposition was offered by the Yeadon and Rawdon District Councils, the Wharfedale Council, and Mrs. Denby, of Tong Park. The preamble of the Bill was then declared to be proved.

Coke Briquetting Plants in Gas-Works.—The Darlington Town Council have approved a recommendation from the Committee, of a deputation who had visited Leeds, Smethwick, and Northampton, where coke briquetting plants are in operation, that a briquetting machine should be put down at the gas-works, and that provision should be made for the installation of a pan-ash and breeze-washing plant. The Council also decided that, in view of the curtailment of coal supplies for gas-works purposes, the attention of the local Members of Parliament should be called to the seriousness of the position, and should be asked to use their best endeavours to assist in obtaining a relaxation of the restrictions.

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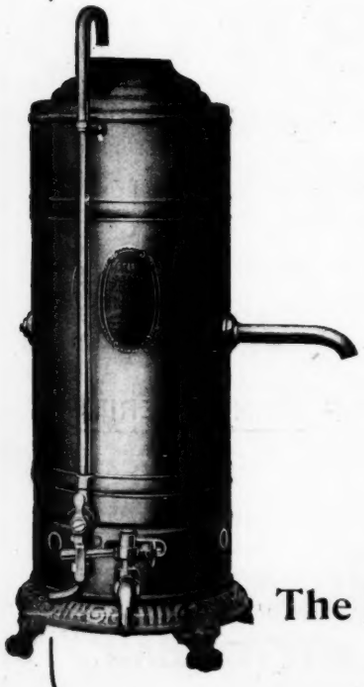

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London Show-Room: 129, High Holborn, W.C.

Belfast Electricity Supply.—At a meeting of the Belfast Corporation, Alderman Tyrrell objected to a proposal to send a deputation to the Local Government Board with regard to the raising of money for the extension of the municipal electricity undertaking. He held that the present works were not comprehensive enough to admit of extensions to meet requirements for the next fifty years, and he could not support a patchwork scheme. There must be something radically wrong, he said, when private firms could generate electricity cheaper than the Belfast Corporation, with its huge output and its monopoly. Mr. Riddell said this was no time for an expenditure of £35,000 on the electricity supply. In the result, the proposal was carried by 15 votes to 10.

The Darlington Corporation have agreed to a recommendation that labourers at the gas-works shall be paid at the rate of 6½d. per hour, with a 3s. war bonus.

In an article describing the South African Temporary Military Hospital in the Home Counties, our contemporary "South Africa" points out that all the cooking is to be done by gas, "since it makes so much for cleanliness and convenience."

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for May 31.]

Nos. 7239—7572.

ELTON, W.—"Automatic alarm-sounding device for gas-lighting systems." No. 7381.
GIBSON, R.—"Bunsen gas tubes or burners." No. 7432.
HAGUE, A.—"Shade holder." No. 7303.
HERSEY, M. H., "Mantle rings." No. 7280.
HULETT, E.—"Manufacture of silicate fire-bricks." No. 7511.
JACKSON, F. B.—"Incandescent burners." No. 7292.
JONES, F. G.—"Jointing metal pipes or tubes." No. 7324.
JONES, T.—"Fluid cocks." No. 7384.
LEWIS, G. P.—"Production of benzene, toluene, xylene, &c." No. 7452.
ROLLIN, C.—"Fire-bricks." No. 7351.
STEIGER, E.—"Electric devices for automatically turning lights on and off." No. 7252.
STEWART, C.—See Gibson. No. 7432.
THOMAS, L. J.—See Hulett. No. 7511.

STOCK MARKET REPORT.

THE course of things on the Stock Exchange last week developed some rather remarkable features. The tendency on the opening day was dull under the influence of the ruling tone of the week before. But on that day, Mr. M'Kenna obtained the sanction of the House of Commons to his scheme for imposing a 2s. super-tax upon American securities wanted by the Government and withheld by the holders. This had the desired effect immediately, and produced an extraordinary rush on the part of holders to hand them in, with the natural consequence that the resulting proceeds of the operation were to a great extent demanding reinvestment. The choicest markets became buoyant. Everything gilt-edged was in request. Treasury Bills, Exchequer Bonds, War Loan, Colonial issues—all were conspicuously strong. War loan rose to 96. Home Rails were in good request, especially debenture stocks and other prior charges. Americans were naturally not in it. The Foreign Market showed firm points: the French loan, Brazilians, and Japanese being in good demand. Argentines were better. South Africans were rather irregular, but seemed inclined to rise on the whole. In the Miscellaneous Market, rubber continued rather dull, and oil concerns were only moderate. The latter article is, of course, much wanted; but the freightage difficulty is an obstacle. Munition undertakings did well, and shipping—despite some little profit-snatching in mid-week—prospered. Business in the Gas Market was a good deal quieter; holders apparently not being anxious to sell. The tone was very firm all throughout the list; the three biggest undertakings being conspicuous in steadily maintaining the improved positions they had attained the week before. In the Money Market, rates generally may be quoted steady. Among general topics, the Government's financial methods came in for more criticism in the City in connection with short-dated Bills and Bonds; but the removal of the disability attaching to British holders of Bonds who are resident abroad is welcomed. In Cassel's case, the Court has upheld the action of the Stock Exchange Committee in declining, without assigning reasons, to re-elect the plaintiff as a member.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 75, 75½, Primitiva (1911) 62, 62¼, 62½, South Metropolitan 80¼, 80½. On Tuesday, British 35, Gas Light ordinary 74½, 74⅝, 75½, ditto maximum 59¾, 60, 60¼, ditto preference 74, 74⅛, Imperial Continental 78, Melbourne 97⅛, Primitiva (1911) 62½, South Metropolitan 79½, 79⅝, 80½, Swansea 89½. On Wednesday, Gas Light ordinary 75¼, 75⅜, ditto maximum 60½, ditto preference 74½, ditto debenture 60, Imperial Continental 79, 80, Primitiva 2, ditto preference 3 5/16, 3⅜, ditto (1911) 62½, South Metropolitan 79½, 80½, Swansea 89. On Thursday, Commercial 3½ per cent. 70, ditto debenture 55, Gas Light ordinary 75¼, 75½, ditto preference 74, Imperial Continental 78, Primitiva preference 3 5/16, South Metropolitan 80. On Friday, Croydon debenture 70, Gas Light ordinary 75⅜, 75⅝, 75¾, ditto debenture 60⅛, 60⅜, Imperial Continental 78, South Metropolitan 79½. On Saturday, Gas Light ordinary 75⅜, Imperial Continental 77.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,651,868	Stk.	April 8	2½	5½	Alliance & Dublin Ord.	59—64	8 18 2	..
274,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 8	..
260,000	5	April 29	7½	8/-	Bombay, Ltd.	5½—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bourne-mouth Gas and Water { 10 p.c.	29—30	5 6 8	..
388,110	10	,,	7	7/-	Bourne-mouth Gas and Water { B 7 p.c.	15—15½	4 10 4	..
115,000	10	,,	6	6/-	Bourne-mouth Gas and Water { Pref. 6 p.c.	13½—14	4 5 9	..
159,740	—	—	—	4	Bourne-mouth Gas and Water { 4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	56/-	Brentford A Consold.	361—366	5 5 8	..
734,930	,,	,,	†11	55/-	Do. B New	304—309	5 5 8	..
55,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
221,400	,,	June 11	4	4	Do. 4 p.c. Deb.	91—98	4 6 0	..
217,380	Stk.	Feb. 26	11	10⅔	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	7⅞	Do. A Ord. Stk.	154—159	5 0 8	..
580,000	20	Mar. 26	19½	22/6	British	44—45	5 11 1	35
190,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1¼—2¼	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
560,000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103—105	5 1 6	70
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	55
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	,,	—	11⅛	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	5⅞	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,009,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	..
16,397,185	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke { 4 p.c. Ord.	98—102	4 15 6	74½—75⅝
2,600,000	,,	,,	3½	3½	Gas Light and Coke { 3½ p.c. max.	76—79	4 8 7	59⅝—60½
4,062,235	,,	,,	4	4	Gas Light and Coke { 4 p.c. Con. Pref.	96—99	4 0 10	74—74½
4,674,850	,,	June 11	3	3	Gas Light and Coke { 3 p.c. Con. Deb.	72½—74½	4 0 6	60—60⅜
190,000	,,	,,	10	10	Gas Light and Coke { 10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16⅝	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅞	7⅜	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅜	5⅞	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	77—80
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
235,342	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
2,498,905	Stk.	Feb. 26	10	5	Liverpool 5 p.c. Ord. { A	211—213	4 18 11	} ..
					Liverpool 5 p.c. Ord. { B	146—148	4 14 7	
806,088	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4¼—4⅝	8 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne { 4½ p.c. Deb.	99—101	4 9 1	97⅞
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 18 4	..
1,875,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—88	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8/2	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd.	117—123	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7⅛—7⅜	6 9 0	..
60,000	50	Feb. 26	18	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5⅛—6	6 18 4	2
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4⅞—5	5 0 0	3 5/16—3 7/16
591,600	100	June 2	4	4	,, 4 p.c. Deb.	91—98	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	62—62½
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	San Paulo { 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	228—234	4 9 8	..
209,984	,,	,,	10	10	Do. B	222—234	4 9 8	..
523,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	79½—80½
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
224,830	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 6	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—113	4 9 8	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
647,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District { A 5 p.c.	135—138	5 6 8	..
782,275	,,	,,	6	6	Tottenham District { B 3½ p.c.	116—117	5 2 7	..
181,255	,,	June 26	4	4	Tottenham District { 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth, Wimbledon, and Epsom—Wandsworth A 5 p.c.	151—155	5 7 4	..
255,686	,,	,,	6⅞	63/9	,, B 3½ p.c.	122—124	5 9 7	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	5 9 0	..
352,000	,,	,,	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅝	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

FEMALE RENTAL CLERKS AND METER INSPECTORS. No. 6182.
CLERK. Sheerness Gas-Works.
COIN-METER COLLECTOR. C. M. C., 155, High Street. Waltham Cross.
GAS FITTER. Denbigh Gas and Water Company.
TAKING DOWN AND RE-ERECTING TANK. No. 6184.
STOKERS. King's Lynn Gas-Works.

Plant, &c. (Second Hand), For Sale.

CAST-IRON TANK. Stevenson and Co., Wandsworth.
PURIFIERS, EXHAUSTER, ENGINES, BLOWERS, TANKS, &c. Bale and Hardy, 39, Victoria Street, Westminster.
RETORT BENCH IRONWORK, CONDENSERS, SCRUBBER, WASHERS, PURIFIERS, EXHAUSTER, ENGINE, GASHOLDER, STATION GOVERNORS, PHOTOMETER, WEIGHBRIDGES, &c. Liverpool Gas Company.

TENDERS FOR

Carbon.

REIGATE GAS COMPANY.

Coal.

ATHERTON URBAN DISTRICT COUNCIL. Tenders by June 14.
HEBDEN BRIDGE AND MYTHOLMROYD GAS BOARD. Tenders by June 13.
MALVERN GAS COMMITTEE. Tenders by June 14.
ROTHERHAM GAS DEPARTMENT. Tenders by June 10.
SAFFRON WALDEN GAS AND WATER COMMITTEES. Tenders by June 24.

Lime.

LOUGHBOROUGH GAS DEPARTMENT. Tenders by June 6.

Roof (Purifiers).

OLDBURY GAS DEPARTMENT. Tenders by June 15.

Tar and Liquor.

LOUGHBOROUGH GAS DEPARTMENT. Tenders by June 6.
READING GAS COMPANY. Tenders by June 19.
ROTHERHAM GAS DEPARTMENT. Tenders by June 10.
WILMSLOW AND ALDERLEY EDGE GAS COMPANY. Tenders by June 21.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

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Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, May 16, p. 361.

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SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.
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GAS LIGHTING ENGINEERS AND CONTRACTORS.
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RETORT SETTINGS, COAL TESTING PLANT, BOILER FIRING.
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It is also used for the Enrichment of Gas.
Manufactured and Supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agents, F. J. NICOL & Co., Pilgrim House, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

EXPERIENCED Man required to TAKE DOWN and RE-ERECT CAST-IRON GASHOLDER TANK, 27 feet diameter, expeditiously.
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WANTED, for the Duration of the War, an Experienced CLERK, capable of keeping Ordinary and Prepayment Meter Rentals. Must be Ineligible for Military Service. Salary, £104 per Annum.
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WANTED—Leading Stoker, used to Shovel Charging, Engine, and Boiler. Also SECOND STOKER. Wages 6s. 3d. and 6s. per Shift (Twelve Hours) respectively, with Bonus, and 5s. Monthly War allowance. Week Holiday Annually. Grant towards Removal Expenses.
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THE Reigate Gas Company, Limited, have 8 or 10 Tons of CARBON for Sale.
Quote f.o.r. Reigate Station to G. MEAD-ROBINS, Engineer and Manager, Gas Office, REIGATE.

EXCELLENT Cast-Iron Tank. 14 ft. by 14 ft. by 5 ft. ¾-inch Metal, about 8 Tons. £60 on Vans London.
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